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Electricity and Papermaking

ONE advantage possessed by hydro-electric over coal-fired generating stations is in the opportunity which they provide of supplying certain off-peak loads at the low rates required if electrical methods are to become feasible. In such cases the smallness of the running charges offsets the higher standing charges usually associated with water power.

Electrical steam raising is a load of this kind, and at Dublin and Cork, for example, energy from the Shannon (to the extent of over four million kWh per annum) is used to assist the peak operation of the boilers in the power-stations and to maintain stand-by. The largest users of such steam are paper manufacturers, and in Canada about one and a half million kVA in electrode boilers is installed in numerous plants. In Norway, also, the system is extending.

In Great Britain, where waterfalls provide less than 3 per cent. of the total output, steam for industrial processes has to be obtained in some other way. Here, again, we have an electrical association, as often when the steam requirements predominate the generation of electricity may be regarded almost as a by-product, and the overall costs of the two services are considerably lowered. In this case the steam provides cheap electricity instead of the cheap electricity providing steam.

The fuel used in increasing the pressure from, say, 20 lb. to 300 lb. per sq. in. is a small proportion of that needed to raise steam in the first place, and the use of pass-out or back-pressure turbines or engines provides a technically sound scheme. In practice, this general consideration is subject to qualification on account of increased capital expenditure, as Mr. R. G. Devey showed in our issue of January 10th, and other factors, such as non-coincidence of steam and electrical loads.

An ideal case for the generation of electricity in this manner is provided by Lloyd's paper mills, the magnificent installation of which we give pride of place in this issue of the REVIEW.

The production of low-pressure steam to an amount of 340,000 lb. per hour is an outstanding feature of this equipment. Yet, in spite of the subordinate part part played by the generation of electricity, the output of the plant ranks it with some of the largest of our capital generating stations. This may not be obvious at first glance, as the maximum demand is relatively low owing to the good load factor at which the plant works.

The production of electricity at Kemsley is less remarkable than its application, as the methods of ensuring the close control required by much of the machinery and the efficient use of some 2,000 motors aggregating 130,000 h.p. for speedy production, no less than the magnitude of the paper-making operations, have probably provided even more scope for ingenuity and planning than has the lay-out of the power plant.

By making the utmost of the advantages of electricity in this way, as well as by trebling the thermal efficiency, and hence securing the lowest practicable running costs of generation that are essential for high load-factor supplies, this works has gone a very long way towards redressing the economic balance between water and coal.

Room for Both?

DISCUSSIONS regarding the future of electricity in relation to gas frequently end with the expression of opinion that there is room for both. If this idea is economically sound, it means that each is capable of carrying out certain functions more efficiently or cheaply than the other. As regards efficiency, there can be little doubt of electricity's pre-eminence; the matter of cost is one that continued reductions in electricity charges will settle in time. Let us assume, however, that gas is likely to survive for some years yet and ask what is the position when rural areas are to be opened up. Extensions in these areas are costly—probably more costly for gas suppliers than

electricity undertakings—and it is only when some return can be foreseen that these extensions are carried out. Is it possible for both gas and electricity suppliers, therefore, to undertake this expensive work with hope of adequate remuneration? The Mid-Cheshire Electricity Co. does not think so, and accordingly has opposed an application for a Special Gas Order by the Winsford Council by which the Council seeks to supply gas in a sparsely populated area in which the company is already supplying electricity. The opposition was said to be the first of the kind for twenty-two years, and the Board of Trade's decision in the matter will be of great interest.

The Spirit of Inquiry

THE annual report of the Electrical Research Association can be recommended for perusal not only by those interested in particular lines of investigation, but also by all who wish to have a working knowledge of technical tendencies in our industry, as these are all subjects of investigation. They may be of immediate practical interest, likely to lead to new, or modifications in existing, British Standard Specifications, or they may possess a deferred value—direct or indirect—that is none the less likely to be a high one later on. A typical example of work in hand relates to the use of glass for overhead line insulation. The old difficulty of mounting glass insulators seems to have been overcome by recent developments in plastic cement. They are used extensively for power lines in France, mainly on the ground that their use enables faults to be readily located.

Electricity and Chemistry

THERE will be much of electrical interest in the Chemical Engineering Congress of the World Power Conference to be held in London next June. Apart from the papers on electro-deposition, electrolytic effects and electro-chemical industries that were to be expected, time will be given to such matters as hydro-electric development, the burning of low-grade fuels, feed-water treatment, arc welding, low-temperature carbonisation, heat exchange and heat insulation. Among the British papers is one sponsored by the Electrical Research Association on the behaviour at high temperatures of carbon and molybdenum steels, which have exercised so much influence in extending the range of steam temperatures that can be employed in generating stations.

London Telephones

THE growth of telephone services at home and overseas has been one of the most encouraging trends of the past year, and shows no signs of abating. On another page we give details of the expansion in London, where, as a result of the enterprise of the Post Office, the number of telephones in use increased at the rate of 1,270 a week, and is now approaching the million mark, while seventy-two million more calls were made than in 1934. It is anticipated that by 1940 all the exchanges within ten miles of Oxford Circus will have been converted to automatic working.

Fire-Hose Conductivity

A REPORT recently appeared in the daily Press that firemen who were directing a jet of water through the entrance of a burning building in Aldersgate, E.C., received shocks from the electrical installation. This statement, we are authoritatively informed, is not correct. It would have been surprising if it had been, in view of the tests on "solid" water-jet conductivity (particulars of which appeared in our issue of July 14th, 1933) which were carried out by the Central Electricity Board on its high-voltage lines. These showed that even at 132-kV at distances of less than 40 ft. and with solid jets no danger existed, but the earthing of the nozzle or the use of rubber gloves was recommended, as is done in the routine washing of high-voltage insulators. Most fire brigades use spray jets or rubber gloves, as the earthing of the nozzle appears to be impracticable, and firemen often unavoidably play upon conductors at low and medium voltages without noticeable results. Nevertheless, it should be worth while to make further investigations under the conditions obtaining in ordinary fire hazards.

Increasing Domestic Usage

STATISTICS collected by the British Electrical Development Association, and referred to on page 166, indicate that the numbers of electrical domestic appliances are increasing at a steady rate. Cookers appear to have made the greatest stride, no fewer than 28,519 having been installed by the 264 reporting authorities in the quarter ended September 30th last, increasing the total by over 7 per cent. The rise in the number of consumers is of peculiar interest in view of the "Million More Consumers" Campaign. Assuming the figure of 108,521 to be representative of the 650 undertakings and of an average quarter, the annual increase works out at over a million, which augurs well for the success of the campaign.

The Distribution Link

CLOSE voltage regulation and freedom from breakdowns may be of even greater consequence in the early stages of a distribution scheme than they are later, when the advantages of electricity have come to be fully appreciated. Meanwhile, consumers expect all the good qualities of the older methods to be maintained in addition. Yet if too heavy an expenditure is estimated at the outset an economic return is unduly delayed or the scheme may not be carried through. In most cases the difficulties are somewhat lessened, as existing consumers bear the development charges. Moreover, as Mr. Hurworth points out on a later page, simplification often tends to improve reliability as well as to reduce costs.

Scientists and Science

LORD RAYLEIGH based his presidential address to the Physical Society last Friday on the belief that the history of science (like any other history) cannot be separated from the men who made it. His personal reminiscences of some of the greatest men of the past generation, and also of their mistakes, serve much more than the negative purpose of reminding us of the limitations of the knowledge with which we have to form our generalisations; they show us the play of fine intellects upon a variety of problems. These men were greater than their work; though the recorded result may be later disproved, or its material embodiment become obsolete, the points of view expressed, often as by-issues, present a source of new ideas to those who follow after them.

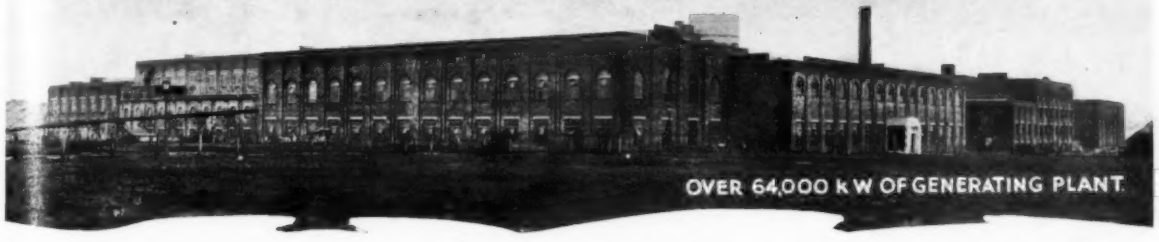
Diathermy and Tonsils

THE use of high-frequency currents for the removal of tonsils has certain advantages over the old methods, according to an article in the *British Medical Journal*. An active electrode both cuts and coagulates, and hæmorrhage should be absent, since the heat seals the blood vessels and also the lymphatic vessels, thus lessening the risk of infection. Complete excision may be performed in one operation, or progressive destruction by coagulation may be carried out over a series of weeks, the latter method having the advantage of interfering little with the patient's duties. The new technique owes its efficaciousness to improvements in diathermy apparatus, which now generates currents of higher frequencies, and to the employment of much smaller active electrodes.

The Gas Man's Rights

THE manager of the Wath, Bolton and Thurnscoe Joint Gas Board is to have his house wired for electricity. When the Board arrived at this decision one member pointed to the absurdity of the proposal, but another representative said that the manager was entitled to "citizen rights." We agree; even gas managers should not be denied the undoubted advantages of electricity.

ELECTRICITY IN PAPERMAKING



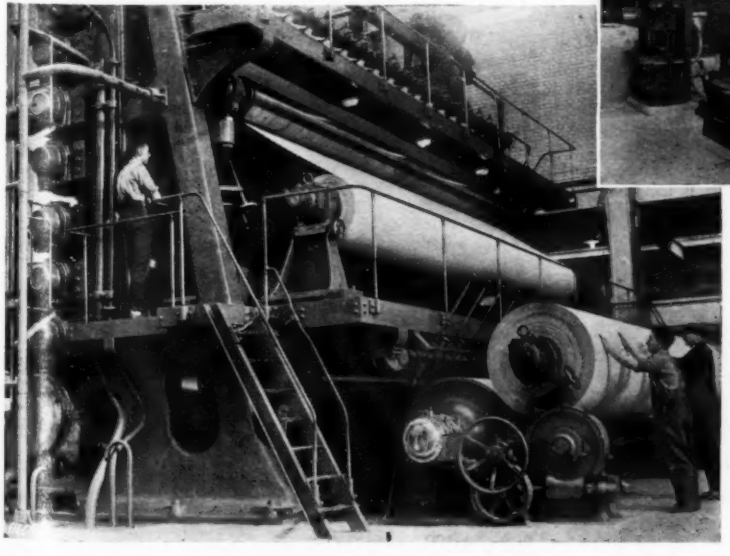
One of the largest industrial electrical installations in the world is that at the paper mills of Messrs. Edward Lloyd, Ltd., Sittingbourne, Kent, which are described in the following pages. In every stage of the process electricity plays its part, necessitating an annual consumption in the region of 350 million kWh, which compares with the output of the Sheffield Corporation undertaking. The whole of this energy is generated at the mills, the power plant aggregating 64,000 kW, and for its utilisation about 130,000 h.p. of motors has been installed. The plant includes the world's largest papermaking machine.

SOFT wood and sulphite (chemically prepared wood pulp for strengthening and improving the product) are the basic raw materials employed for papermaking as it is practised at the large modern and recently extended mills at Kemsley, near Sittingbourne, of Messrs. Edward Lloyd, Ltd. The materials are received by ship from abroad at Ridham Dock, the company's private port situated on the Swale about 1¼ mile from the mills.

Products of the mills are shipped from the same port, where for loading and unloading there are installed on the dock wall some five-ton four-motor cranes supplied by Messrs. Stothert & Pitt, Ltd., and Messrs. Babcock & Wilcox, Ltd. The operating capacities of these cranes are: Hoisting 50 h.p., slewing 17 h.p., derricking 10 h.p., and travelling 15 h.p. Electrical equipment on the dock cranes is of B.T.H. manufacture. For off-loading from trucks to storage stacks and vice versa there are also two-ton gantry cranes about the dock, the gantries having 24-ft. centres.

All the crane motors operate at 430 V, 3-phase, 50 cycles, the normal l.v. distribution system at the works, and they are supplied from special plug boxes placed at 60-ft. intervals along the dock wall and at the sides of the stack avenues. The plug boxes, made by Messrs. Siemens Bros. & Co., Ltd., each have flat-type line and earth plug and socket contacts and self-contained fuses all in a common cast-iron casing. They are of 200-A capacity, are constructed with a cable entry bell at the back, and are either mounted on short metal standards or recessed in the concrete dock wall. For night operation many of these plugs have installed beside them a small prismatic bulkhead lighting fitting supplied by Messrs. Heyes & Co., Ltd.

Two very large paper storage sheds in the docklands each have inside two three-ton, four-motor cranes with operations as follows: Hoisting 30 h.p., cross-travel 7½ h.p., and long travel 7½ h.p. (two motors). These are Royce cranes fitted with Metropolitan-Vickers motors. They unload from the store to rail trucks which bring the mill's products to the docks.

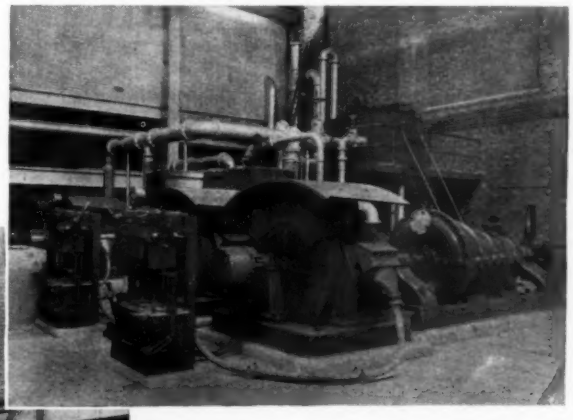


There is a good deal of coal handling done at the docks too, in connection with which there has just been installed a truck tippler which deals with coal which is rail borne to the dock. This is driven by a 25-h.p. Laurence, Scott motor, and in conjunction with it there are four motor-driven conveyors. Sea-borne coal is handled by the dock cranes.

Motor-driven pumps in the two dock fire stations are all part of the electrical installation at the port, where the total load is about 400 kW. This is supplied by a 500-kW transformer station fed at 6,600 V direct from the power station at the mills.

The raw material required for the manufacture of paper is conveyed from the docks to the storage pile by means of an aerial ropeway. At one end there is a simple 50-h.p. drive with combined liquid starter and circuit-breaker control. From the storage pile there are conveyers which supply the mills with raw material, and these are electrically operated by various motors of 35 h.p. and 85 h.p. Each motor has a liquid starter and switchgear.

The plant installed for the purpose of dealing with the raw material includes six 2,500-h.p. motors and ten 1,250-h.p. motors, supplied by the English Electric Co., Ltd., and for the extension seven 2,500-h.p. motors manufactured by the General Electric Co., Ltd. Each of the new main motors is



Left: A super-calender. Above: Refiner drives

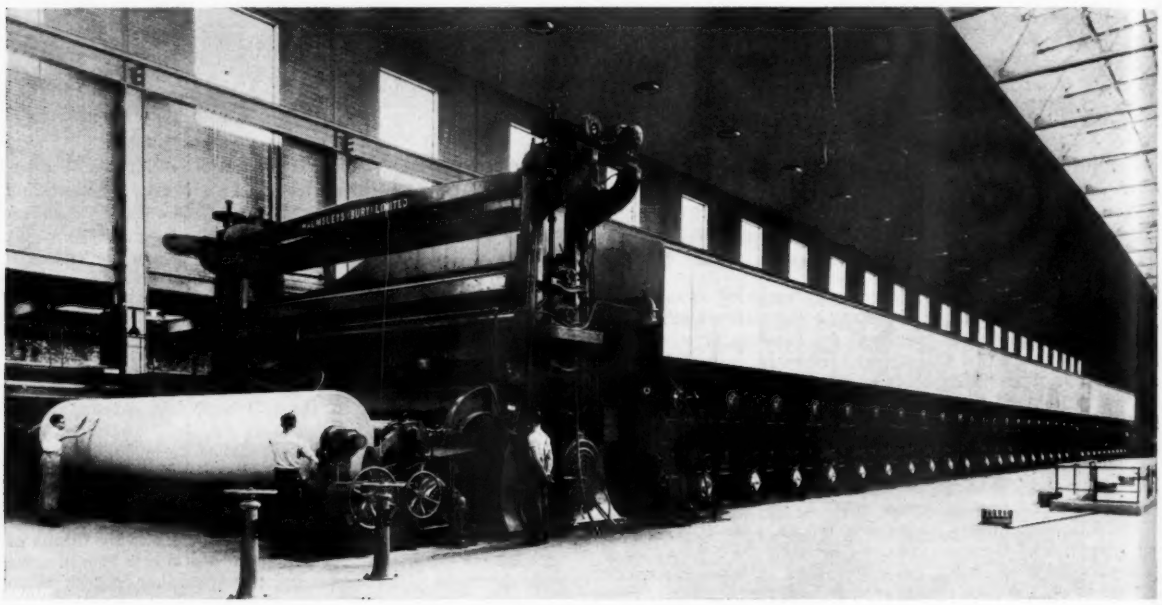
served by a phase advancer of the same make. These advancers are of the shunt type, each comprising a small squirrel-cage motor directly coupled to a three-phase commutator machine. The rotor of the latter is similar to a d.c. armature except that the commutator is provided with three brush spindles per pair of poles, while the compound-wound stator permits p.f. correction independently of the load on the main motor.

The main motors are controlled by a 14-panel truck cubicle switchboard in which the stator oil circuit-breakers are mounted, seven liquid starters, and remote control cubicles, while for each phase advancer an automatic star-delta starter and change-over switch are provided. The function of the change-over switch is to disconnect the liquid starter after the main motor has run up to its full speed and to connect the phase advancer in circuit.

On the remote electrical control cubicle for and near each

main motor the operating handle is coupled through bevel gears and operating rods to the liquid starter and change-over switch on the floor above. The main truck cubicle switchboard has four incoming feeder and two 3,000-kVA transformer panels, while seven panels control the supply to the stators of the 2,500-h.p. motors. The 600-A, 6,600-V oil circuit-brakers are motor operated, and each of them has a rupturing capacity of 500,000 kVA.

Emergency push buttons for stopping the machines are provided at convenient points, and there are also suitable shut-down alarms.

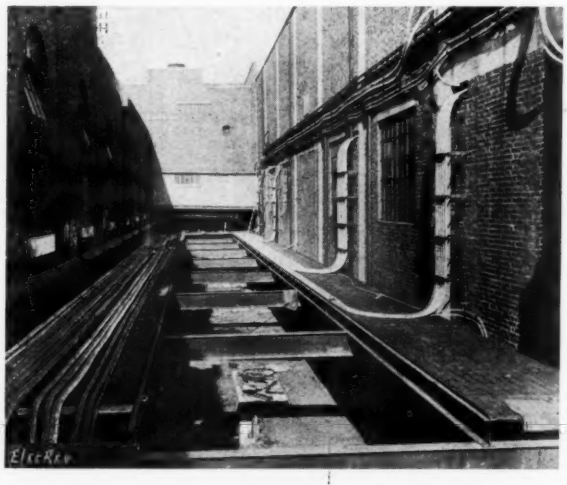


The mammoth machine which produces 320-in. wide newsprint at 1,400 ft. per minute

On the latest equipment the first screens are driven by a number of 100-h.p. G.E.C. motors, and the second and third screens by 50-h.p. English Electric motors.

The stuff chest is at the extreme wet end of the paper machine, and from it the pulp and water mixture is pumped to a set of screens each driven by a 5-h.p. English Electric motor through David Brown gearing. Considerably reduced in water content the mixture is now conveyed into the breast box and up on to a wire screen conveyor, over which it is evenly spread. From this travelling screen the bulk of the remaining water is sucked away by vacuum, after which the pulp is compressed between rollers; the remaining operations right down the paper machine involve various stages of rolling and drying over steam-heated cylinders.

Because of the growth of the paper due to compression at various stages on the machine provision has to be made in the drives for speed increases progressively down the length of the machine, and it is in connection with this variable-speed driving that the electrical engineer has been able to demonstrate to great advantage the superiority of electrical operation as compared with older methods.



Some of the cable runs; main control cable on the right, feeders on the left

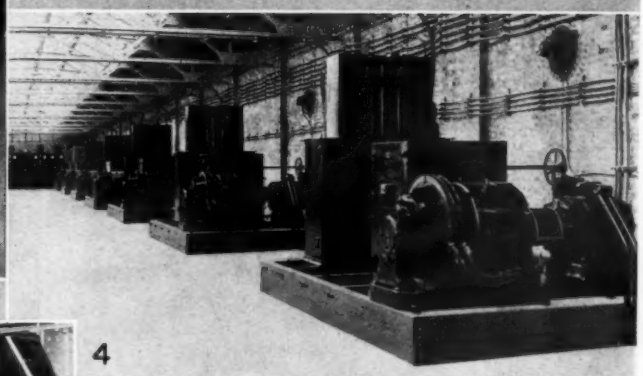
These, briefly, are the general operations on any modern paper machine, but the dominating interest at these works is created by the latest paper-making machine supplied by Messrs. Charles Walmsley & Co., Ltd., because of its outstanding advance in speed of production over what had previously been done. This giant is the largest paper-making machine in the world, and produces newsprint paper 320 in. wide at 1,400 ft. per min. Each section is driven through reduction gearing by one or, in the case of the couch and calender sections, two c.h.t. variable-speed a.c. commutator motors in which the speed is varied by moving the brush rings in opposite directions on the commutator. This load-compensation movement is carried out automatically by regulating gear, which maintains contant the relation between the speed of the individual motor and a common master in the form of an alternator driven by a c.h.t. motor by virtue of the frequency of the master alternator, from which a supply is taken to each regulating gear. The speed of each motor can be adjusted over a range of 22-½ per cent. for a given fixed speed of the master alternator.

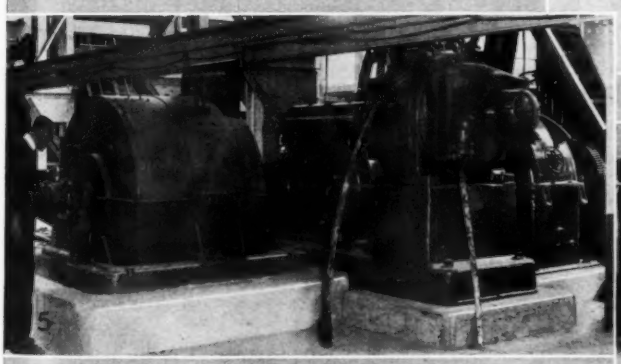
Barring motors provide for inching and creeping on all sectional drives, and "creeping" speeds at the wet and dry ends of the machine are 100 ft. per min. and 50 ft. per min. respectively. Each sectional drive operates independently as regards stopping and starting. A small motor generator supplies the field of the master alternator and the regulating gears. Each vacuum box on this machine is served by a Drysdale pump driven by a 30-h.p. English Electric motor, and the vacuum couch is served by a 375-h.p. motor-driven vacuum pump of similar make. The tremendous increase in suction power is due to the fact that at the couch stage all the free water has been removed and the operation is really that of extracting moisture from the solid.

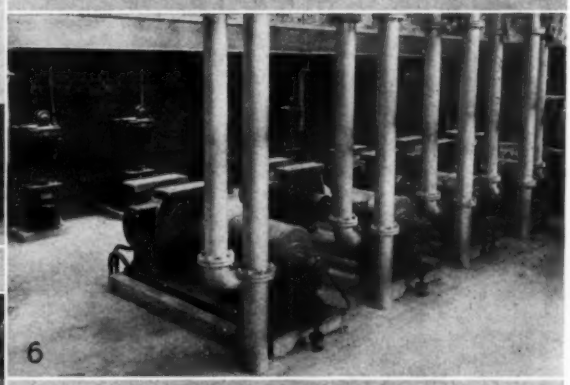
Two suction presses after the vacuum couch are each served by a 150-h.p. English Electric motor. The machine calender is the dry end extremity of the machine, which has an overall length of 409 ft.; a wet-felt vacuum pump is driven by a 75-h.p. motor. The machine drives proper were supplied by the British Thomson-Houston Co., Ltd.

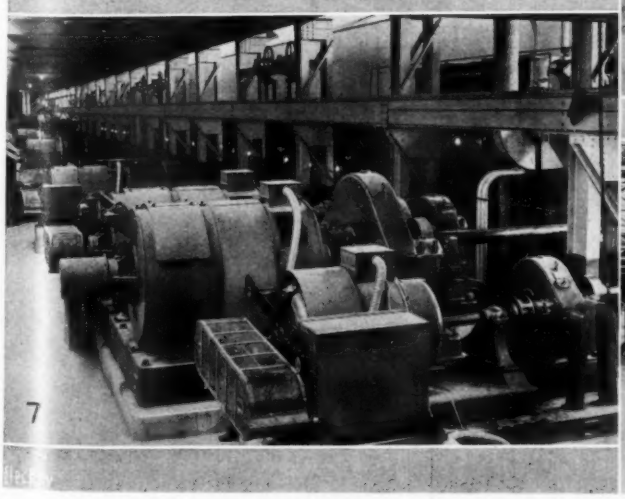
At the wet end of the couch section there are two 275-h.p. motors driving through gearing, and the first and second press drives are driven by 200-h.p. commutator motors with similar gearing. The barring motor for each of these main-drive motors is 30 h.p. In the dryer section there are three sub-sections, each gear-driven by a 275-h.p. commutator motor equipped with a 60-h.p. barring motor. The machine calender is driven by two 200-h.p. motors with 60-h.p. barring motors. The gearing in each case is by the Power Plant Co.

A sub-station for the machine drive and auxiliaries supply and control is situated in the basement underneath the drive, and it houses four 2,000-kVA, 6,600/430-V 3-phase transformers (English Electric Co.), ten h.v. and fifteen l.v. B.T.H. truck units, a B.T.H. automatic contactor control board, the master alternator for









Messrs. Edward Lloyd's Paper Mills, Kemsley

1. Stacks of wood pulp. 2. 2,500-h.p. motors for producing the pulp. 3. Control board for paper machine drives. 4. Phase advancers and liquid starters and change-over switches for 2,500-h.p. motors. 5. The super-calender drive. 6. Pumps for removing water from the material in the semi-solid state. 7. New paper machine drives; machine calender drive in foreground. 8. Truck board for controlling pulp motors

speed control, exciters, ventilating fans for the motors, a Johnson & Phillips industrial board and a number of high-rupturing capacity fuse boards (English Electric) for sub-circuits, and also the motor generator for the super calender. This sub-station is 315 ft. long and 20 ft. wide.

All the water and stuff pumps on the machine, together with their driving motors, were supplied by Messrs. Mather & Platt, Ltd., and the sets range in size from 5 h.p. up to 175 h.p.

After being reeled the paper is recalendered on a super-calender driven by a 750-h.p., 550-V d.c. motor with a 100-h.p. a.c. barring motor. The main motor is controlled by a contactor panel and the barring motor by resistance equipment. The d.c. motor is served by a 600-kW motor-generator set driven by an 850-h.p. directly coupled 6,600-V motor with Ward Leonard control.

Finally, on a re-reeler the paper is cut into widths suitable for rotary printing presses. This machine is driven by a 100-h.p. a.c. motor with a resistance controller. The new machine house is spanned by 50- and 25-ton six-motor Wharton cranes with Metropolitan-Vickers motors, the hoist motor of the 50-ton crane being a double-rotor squirrel-cage unit.

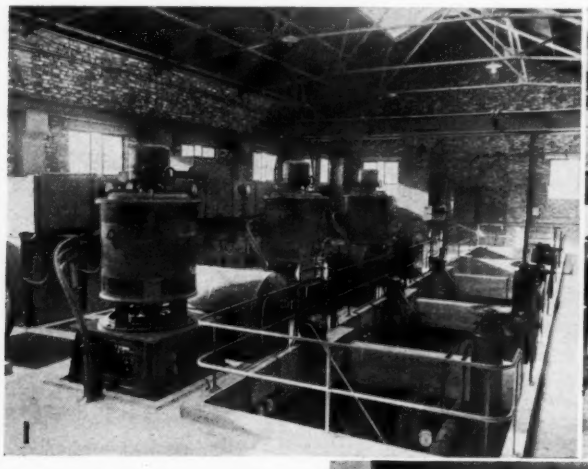
As a general rule all the motors up to about 85 h.p. are controlled by Allen West starters with oil circuit-breakers, and above that capacity the a.c. motors are controlled by equipment supplied by Messrs. Johnson & Phillips, Ltd., the English Electric Co., Ltd., and the General Electric Co., Ltd. An outstanding exception to this rule is the 375-h.p. motor on the couch vacuum pump, which also has liquid starter and oil circuit-breaker control. Messrs. Johnson & Phillips have supplied about eighty transformers ranging from 500 W to 3,000 kVA, including a 40-kV testing transformer for general and oil testing.

The Power Plant

The extensions to the mills are essentially associated with a scheme of electrical development which started at Sittingbourne in 1908, and the full story covers the work at both Sittingbourne and Kemsley as a whole.

It is a remarkable record of electrical progress. During this period not only has practically continuous mill output had to be catered for, but at the same time 9,850 h.p. of mechanical drives have been converted. When Mr. E. E. Fuller, chief electrical engineer, first took charge of the electrical department at Sittingbourne in 1908 there was installed 100 kW of generating plant for lighting. To-day at both Sittingbourne and Kemsley 64,150 kW of generating plant serves practically the whole of the power requirements throughout the mills. This is installed in three power stations —Sittingbourne, Kemsley No. 1 and Kemsley No. 2, whose plant capacities are now 8,400 kW, 10,000 kW, and 45,750 kW respectively. Last year's output was a little more than 250,000,000 kWh, or just about the output of the Sheffield electricity undertaking for the same period, and the estimated output for 1936 is about 351,000,000 kWh.

Kemsley station No. 2 is now equipped with 20,000 kW of pass-out turbo-alternators and 25,750 kW of straight condensing sets. One 10,000-kW set installed in No. 1 station is of outstanding interest on account of its performance. It is a 10,000-kW two-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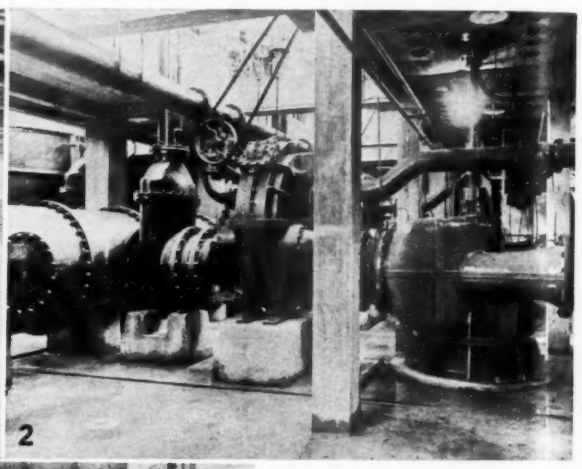
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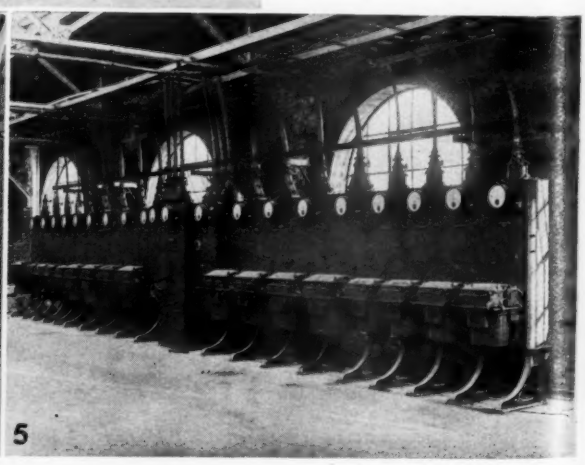
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Auxiliary Plant at Kemsley

1. Main circulating pumps. 2. Pumps and screens in pump-house basement. 3. Main switchgear. 4. Low-voltage distribution panel. 5. Low-voltage gear for auxiliaries.

cylinder Fraser and Chalmers set with pass-out provision at both the h.p. and l.p. cylinders. While maintaining its full electrical load it will supply process steam at 105 lb. per sq. in. at the rate of 105,000 lb. per hour and 85,000 lb. per hour at 18 lb. per sq. in. About 46,300 lb. per hour of steam is exhausted to the condenser when the set is supplying the maximum amount of process steam.

The three turbo-alternators included in the latest extension are all installed in No. 2 station, which has been suitably extended, and they include a 15,000-kW and a 5,000-kW pass-out set and a 750-kW straight condensing set. They were all manufactured by the English Electric Co. and designed for a stop-valve pressure of 300 lb. per sq. in. and 700° F. total temperature. The 15,000-kW set is capable of a pass-out of 240,000 lb. of steam at 20 lb. pressure, and the 5,000-kW set will pass out 140,000 lb. at the same pressure. The 15,000-kW set is a twin-cylinder impulse-reaction turbine with duplicate Drysdale extraction pumps and duplicate Mirrlees Watson air ejectors. The circulating water is taken from the Swale, and a chlorine plant is employed to treat the salt water at the pumping station.

In the smallest set the 7,000-r.p.m. turbine has a gear drive to the alternator. It is a single-cylinder machine with one Curtis and seven impulse wheels, and the stop-valve conditions are similar to those of the larger turbines.

Pumping Plant

In order of size the quantities of water dealt with by the condensers of the three turbines are 16,750 gal., 5,760 gal. and 1,000 gal. per minute, respectively. Three new Drysdale circulating water pumps have been installed in an extension of the pump house on the near bank of the Swale at a point about 750 yards from the power station. The battery of 24-in. pumps runs at 735 r.p.m., and will deal with 12,000 gal. per minute under a total head of 88 ft. Each is driven by a 450-h.p. English Electric motor controlled by a liquid starter of similar make, with a Ferguson Pailin drop-down draw-out circuit-breaker.

Bailey rotary strainers installed at the water inlets were supplied by Messrs. Hick, Hargreaves & Co., Ltd. As a precaution against shut-down the house set can run on the mill fresh water supply for which purpose there is a sump in the power station basement equipped with a Drysdale circulating pump.

There is one 36 in. delivery pipe for the extensions from the pumping station to the bus main at Kemsley power station from which the water passes straight to the condensers through 26-in basket strainers (Blakeborough). The circulating water is discharged into a disused dock in the Swale about 1,000 yards from the pumping station. At the intake chamber there is a tide measuring instrument which gives remote indication in the power station by the Elliott-Shotter pressure-diaphragm system. The condensate is continuously tested by "Dionic" equipment supplied by Evershed & Vignoles, Ltd. The main and pass-out steam and condensate measurements are all taken continuously by Electroflo equipment.

There are approximately 700 instruments by Elliott Bros. (London), Ltd., installed at Kemsley Mill, including indicating and recording ammeters, voltmeters and wattmeters (a.c. and d.c.), frequency and power factor meters, summation wattmeter equipment and flow meters.

The new boiler plant consists of four 100,000-lb. per hour Stirling tri-drum boilers with forced and induced draught. For the i.d. Sturtevant fans are employed driven by B.T.H. commutator motors with suitable contactor starters. Davidson rotor fans provide the f.d. and are driven by 30-h.p. Metropolitan-Vickers motors. For each boiler two 7½-h.p. booster fans supplement the f.d. Two 360-h.p. motor-driven boiler feed pumps supplied by Mather & Platt, Ltd., serve the new boilers.

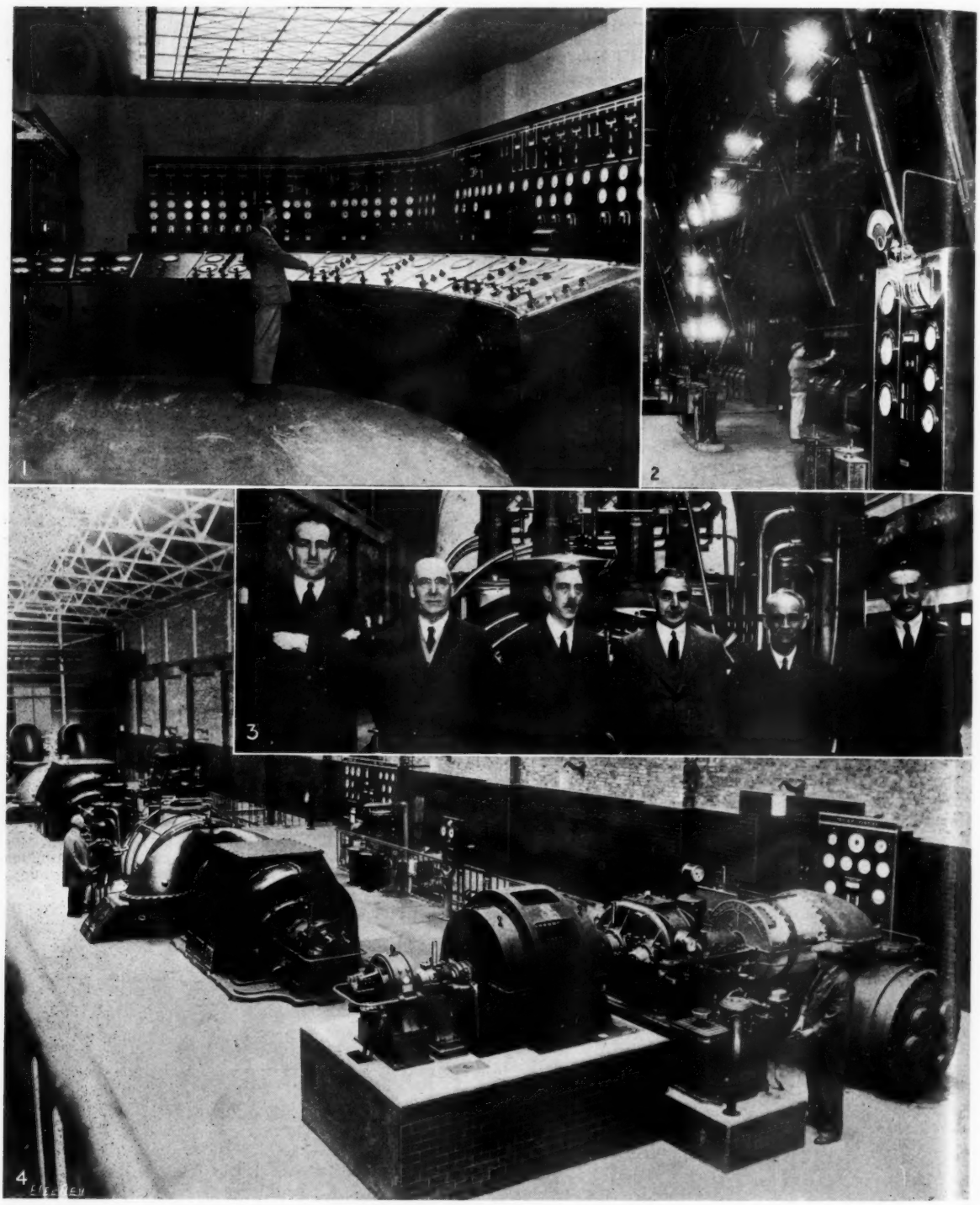
The steam distribution and boiler feed arrangements are of the simplest possible character. The pass-out steam is transmitted to the new paper machine by a 30-in. diameter pipe carried on gantries across the yard for a distance of about 900 ft. All the steam piping has been supplied and erected by Messrs. Aiton, Ltd., and all the steam valves are of Hopkinson production.

Generation is at 6,600 V, 3-phase, 50 cycles, and the main 500,000-kVA Ferguson Pailin switchgear deals with all the energy produced at this pressure. This duplicate bus-bar switchgear is cellular, equipment with drop-down oil circuit breakers which are remotely electrically controlled. Serving 3,000-A bus-bars are nineteen equipments for the machines, feeders, isolators and earthing. The breakers are equipped with cross-jet explosion pots for the purpose of arc elimination and are also provided with mechanical "on" and "off" indicators.

Distribution and Control

An outstanding feature of the extension scheme is a new control room which serves for the whole of the Kemsley plant, both old and new, and we can well believe that this is one of the finest industrial generation control outfits in existence. It is equipped with Ferguson Pailin apparatus. There is an eleven-panel l.p. distribution switchboard supplied by Johnson & Phillips, Ltd., and fed from a 1,250-kVA transformer for the boiler house auxiliaries. But for the main l.p. distribution there is a bank of ten 75,000-kVA and 50,000-kVA single bus-

A general view of the power station with the new 15,000-kW set in the foreground



The Power House and Operating Staff

1. The control room. 2. The boiler house. 3. Mr. Fuller and his assistants (left to right: Mr. A. C. G. Witts, testing engineer; Mr. F. W. Smith, electrical superintendent, Sittingbourne; Mr. E. E. Fuller, chief electrical engineer; Mr. J. H. Turner, electrical superintendent, Kemsley; Mr. W. B. McLeod, assistant superintendent, Kemsley; and Mr. S. H. Bing, mechanical engineering assistant). 4. Another view of the station showing the 5,000-kW set and the 750-kW lighting set in the foreground.

bar drop-down F.P. units with safety screens and remote control.

General l.p. distribution is at 430 V. This is all served by two 1,250-kVA English Electric transformers which, together with the main switchgear, were supplied by Messrs. Ferguson Pailin, Ltd. From the h.p. cellular equipment there are 6,600-V feeders direct to the beating plant, the new paper machine, the pumping station, Ridham dock and the boiler house sub-station, while similar cables interconnect all three stations.

Except for the h.p. equipment, which is dealt with direct from the main switchboard, all the new beating plant equipment is served by two English Electric 3,000-kVA transformers and switchgear of the same make. At the pump house there is one 1,250-kVA English Electric transformer. Between No. 2 power station and the mill there is a 25 ft. wide open space, which, spanned by substantial girders at a height of 11 ft. from ground level, forms a very imposing and effective distribution rack for the whole of the outlet cables, h.p. and l.p. and pilots, from the power station. Callender's, Henley's, Johnson & Phillips, and Glover's, all seem to have contributed to the cable work.

Messrs. Johnson & Phillips, Ltd., inform us that in addition to the large amount of switchgear provided by them, during the past 4½ years they have supplied over thirty miles of l.p. cable for the power and lighting network with a corresponding amount of cable for the main distribution.

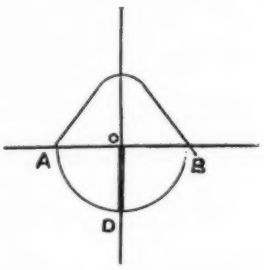
All the electrical work was carried out to the specification of Mr. E. E. Fuller, chief electrical engineer to Messrs. Edward Lloyd, Ltd., to whom we are indebted for permission to publish the foregoing information.

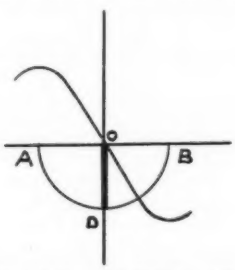
Simplified Alternating Currents. By C. Turnbull, M.I.E.E.

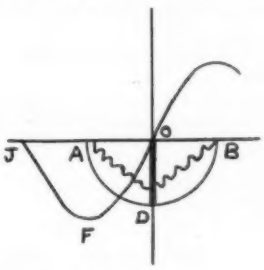
IT is a great loss to the electrical industry that Dr. Drysdale's book, "The Foundations of Alternate Current Theory," has not received the recognition which it deserves and that the sequel which he contemplated has not been written. He explains a.c. in mechanical terms, stating that mechanical analogy is useful even to expert mathematicians. Seeing that Clerk Maxwell and Kelvin laid the foundations of a.c. theory on mechanical analogy, there is no reason why engineers should be ashamed to follow them. Indeed, one may hope that some day the I.E.E. library will be furnished with Drysdale's models so that people may see how a transformer works and how transients occur by studying engineering models which illustrate them in a mechanical manner.

A mechanical analogy

A simple model for explaining a.c. may be contrived out of an ordinary room door. Those who wish to follow the method should swing the door as they read, and they will find it easy enough; not only so, but much of the mystery of a.c. vector diagrams will disappear. A.c. is really not so difficult a subject as it looks in text-books; it is the way of presenting it that is more difficult than need be. In the diagrams OD is the door that swings from left to right, and the sine wave above the line represents the pressure (applied by hand) necessary to make the door swing, the height of the ordinate being proportional to the pressure applied. (It may be said that the sine wave is not quite correct, seeing that the door movement is given by space and the sine wave works in time, but this item may be overlooked for the present purpose.)







Figs. 1, 2 and 3 (left to right)

Let the door scrape against the carpet to give friction and let it be so light that its momentum may be neglected. Push from A to B (fig. 1) with a pressure which varies according to the sine wave; the speed will vary with the pressure, and when the pressure ceases the door will stop. The speed corresponds to current and the pressure to volts; the two are in phase, and the model illustrates unity power factor. This shows why a non-inductive current is easily broken, because the current comes to a standstill at the end of each wave. Small currents are thus easily broken by a slow-break switch which allows the wave to come to zero in a natural manner. Though this has been known for many years, slow-break switches have only recently come on the market. Probably they would have been here sooner if the mechanical analogy had been better known.

Lagging Current

Putting current through an inductance has the same effect as weighting it. To imitate the effect we add weights to the door and take away the carpet friction, seeing that we want the effect of inductance by itself. The weighted door, swinging without friction, is like a transformer on open circuit or a choking coil. The speed is no longer proportional to the pressure, nor does the door stop when the pressure is removed. The door gets its greatest push at the beginning of each swing and increases its speed as the pressure goes down, until it gets its greatest speed in the middle of the swing when the pressure has ceased. The door is then received by the other hand and is pushed in the opposite direction until it comes to a stop. We see now what is meant by the statement that the current goes against the volts, which is so puzzling to students: the current (weighted by the inductance) has a momentum which carries it on for a time even when the voltage is in the opposite direction to its motion.

The pressure is greatest at A (fig. 2), when the door or current is at the beginning of the swing; it drops to zero in the middle of the swing (when the current or door speed is at its maximum), and from D to B the door (or current) is moving against the reversed pressure. The pressure driving the door is in quadrature with the speed in the same way that volts and amperes are in quadrature in a choking coil. The operation is wattless over a cycle, not because no work is being done (a very large amount may be done), but because the energy given out by the generator at one part of the oscillation is driven back into it and motors it during the other part.

A heavy door could be kept swinging, if frictionless, by a small motor provided with a heavy flywheel to absorb and give out energy, but the stresses in the rods swinging the door would be quite as great as if the work was "wattful." A lagging current, without resistance, does not rotate a wattmeter, because the energy flows from the generator during part of the wave and motors it during the other part, but if the meter were sufficiently sensitive it would oscillate to and fro, as an oscillograph does.

Wattless current is more difficult to interrupt than wattful current, because it has no null point. The volts are at their peak at the end of the swing and the amperes in the middle, and the switch has to break energy where it interrupts current.

Take the weights off the door and add buffer springs (fig. 3). Starting with the door at OD we push it against the spring at the left-hand side until it reaches OA; the force of the push is shown by the sine wave JF. The pressure is greatest when the door reaches the beginning of its swing at A when it has compressed the buffer spring. This corresponds to alternating voltage on a capacity, which is charged up most when the voltage is highest. As the pressure is reduced, the door comes back until, when the pressure has reached zero, the door is in the middle of its swing. The swing leads the pressure, as amperes lead the volts. The same kind of action takes place when the door swings from the mid point to B.

Resonance

The strange things that may happen on a big system when capacity and inductance are combined in suitable proportions can also be explained by analogy. Retain the springs and add weights to the door. The momentum of the weights tends to keep the door moving at the end of the swing, but the springs should be just powerful enough to check it, and the door comes to a stop at the end of each impulse of the hands. The door swings in phase with the impulses; the capacity has neutralised the inductance; the amperes and volts are in phase. At the same time, something else has happened. Start the door swinging and it will continue to swing, which did not happen in the previous cases. Similarly, a circuit containing capacity and inductance will continue to oscillate for a time if the circuit is disconnected and short-circuited.

If the door is allowed to swing freely and a series of impulses is given to it in synchronism with the natural period the door will get up a swing which may cause it to break its hinges. In the same way, a circuit containing capacity and inductance in proper proportions may be excited to a state of electrical oscillation which may cause it to splash over its insulation. In each case an accumulation of energy ultimately gets out of hand. The addition of resistance will reduce the tendency of the circuit to accumulate energy in the same way that friction will prevent the door from getting up a swing.

I have assumed that the door or current has got into its swing before observations are made, but this may take a little time in the electrical circuit where there is capacity or inductance. On first switching in there is a unidirectional effect which settles down more or less gradually into a.c. To imitate this one may place a billiard ball in a channel to ensure that it runs straight. If the ball is pushed it will get up speed as long as the impulse continues, and will attain its maximum speed when the impulse ceases. A similar reverse impulse will bring it to a standstill, but will not reverse its motion. The ball would go on indefinitely in one direction, in spite of the alternating impulses, if there were no friction. Friction will cause the ball to stop before the reverse impulse has quite ceased, and will get up a slight reverse movement which will increase each time until eventually the ball will oscillate evenly to each side. The same effect occurs electrically, as may be seen in oscillograms taken when a large system is first switched in.

Instead of a door a light flywheel may be used, arranged so that it can be weighted and also supplied with springs and brakes. The flywheel will oscillate like the balance wheel of a watch and can be driven either by hand or by a weight.

Consumers' Rights to a Supply

From a Legal Correspondent

THE judgment in the case of Brand *v.* the Glasgow Corporation which came before the Scottish High Court of Justiciary, and was reported in these columns in July, appears to have raised a number of interesting and important questions concerning the right of occupiers of premises to a supply of electricity. The facts, as outlined by the Lord Justice Clerk, were that the complainer, Mr. James Brand, was the tenant and occupier of a house in Maryhill, Glasgow. He desired to have electricity in his house and he arranged for an installation to be put in at his own cost. He was informed by the owner's agents (known in Scotland as the "factors") that he might select his own contractor. No condition was attached to the consent and nothing was said about the size of the wiring. When the installation had been put in, he applied to the Glasgow Electricity Department for a supply.

The application was made under Section 21 of the Corporation's Electric Lighting Order, 1890, which provides that "the undertakers shall, upon being required to do so by the owner or occupier of any premises situated within 50 yards from any distributing main of the undertakers, give and continue to give a supply of energy for such premises in accordance with the provisions of the Order." On receiving the request, the Corporation informed Mr. Brand that it was awaiting the official consent of the agents. The agents, however, withheld their consent on the ground that the wiring installed by the contractor was 3/.029 instead of 3/.036 which was the size used by the agents when they themselves carried out an installation.

In consequence of the agents' refusal to consent the Corporation declined to give the occupier a supply of energy. The occupier thereupon brought an action against the Corporation for failure to supply and it was heard by the Sheriff-Substitute who found that the Corporation was not at fault, but submitted the question for the opinion of the Court as to whether his decision was correct. The Lord Justice Clerk held that it was not. He contended that the Corporation was bound by its Order to furnish a supply upon being requested to do so, and not only when the consent of the factors of such premises could be obtained.

Not a "Dangerous" Installation

No attempt had been made by the Corporation to say that it was not reasonably satisfied that the electrical lines, fittings and apparatus in the premises were not in good order and condition or that they were calculated to affect injuriously the use of energy by the undertakers or by other persons. The only argument put forward by the Corporation that had even the appearance of plausibility was that the main cable which conveyed the current from the street main to the occupier's door belonged to the owners of the property of which his house formed a part and that the agents had given no permission for the use of this main cable for the conveyance of electricity to his house. The suggestion, apparently, was that the cable from the street main to the occupier's door was not part of the premises let and therefore the Corporation would be guilty of a legal wrong if it was to use this connecting cable for the supply of electricity. The Lord Justice Clerk regarded this as a mere pretext of the Corporation for its failure to discharge its clear statutory duty.

He was unable to assent to the view that house agents had any power of veto upon the right of occupiers to the use of any public service whether water, gas or electricity provided under the authority of Parliament for the use of the community or that they were entitled to prescribe a particular size of cable when the undertakers, who were the proper statutory authority, were satisfied, as they were in this case, that the wiring was in good order and condition. If the Corporation were in the right it would mean that every occupier of premises in Glasgow might, at the option of the property owners or the house agents who represented them, be compelled to substitute new and different cables for existing ones, although the undertakers themselves were satisfied of their sufficiency.

Agents and Fire Risk

The majority of the Court, however, consisting of Lord Hunter and Lord Anderson, upheld the decision of the Sheriff-Substitute and found that the Corporation was entitled to refuse a supply. The house occupied by Mr. Brand was not a separate tenement and the main cable which conveyed the current from the street main to his premises belonged to the owners of the property. The owners or agents were, therefore, interested in the question of fire risk and might have had cause for action against the Corporation if the latter had ignored their refusal to consent to a supply. The question whether the owners of the property, whose cable was to be used, were bound to give their consent to the occupier's proposals could not properly be tried in a complaint against the Corporation to which they were no parties.

It was for the agents to prescribe the conditions of letting, and there was nothing in the Glasgow Order to take away the Common Law rights of a landlord to prescribe the conditions on which he was prepared to let his property. If the conditions were thought to be too exacting the tenant could seek other premises. Admittedly, on this view the owner had a predominant voice in the matter of supply of electricity to his tenants, but this, the judges contended, ought to be so as the interests of the owner were paramount. The alternative would be that the wishes of the occupier would prevail and that, however dangerous the installation might be, he would be entitled to a supply.

We understand that consequent upon this decision the position at the present time in Glasgow is that the Corporation will not give a supply to an occupier of premises who is not the owner unless the occupier first obtains the consent of the owner or his agents for the installation. The Corporation's requisition form now contains the following term: "The applicant must obtain the consent of the proprietor or his legal representative for all work in connection with the installation of electricity." On the face of it, this means an important modification of the statutory provisions relating to the supply to consumers as it substitutes in effect a condition that only the occupier who has the owner's consent instead of the owner *or occupier* is entitled to a supply.

In Brand's case the purported grounds of the agents for refusing consent were that the conductors in the installation were not large enough, but if one interprets the views of the majority of the Court aright the ground of the refusal to consent by the agents was not material. It might have been that the occupier had not employed a certain contractor of their choosing or had not conformed to some stipulations which were quite unnecessary from the point of view of safety, or had not paid some fee demanded by the agents. One can visualise all kinds of possibilities arising which might be used by the agents as a ground for refusing the supply. The agents may be interested in a gas company and may impose all kinds of difficult conditions in respect of an installation in order to prevent an occupier enjoying a supply of electricity.

Conflicting Interests

The principal argument of the majority of the Court for upholding the attitude of the Corporation was that the agents had an interest in the property and were entitled to make conditions under which the installation should be installed. They regarded it as a hardship that the owners should be compelled to have a supply of electricity in their premises on the request of the occupier. If one may say so with great respect, the possibilities of hardship being imposed on the owner are less than the hardships on the occupier who is denied the right to a supply. The fears expressed that the occupier might get a supply, no matter how unsafe the installation, seem to us to be groundless, as the undertaker has always the right to refuse a supply in that event. The right to refuse a supply ought surely to reside in the undertaker and not in the owner.

One important result of the decision in this case is that whereas the obligations of a supply authority in respect of consumers' supplies are governed by the Electricity Commissioners' Regulations the owners of the premises are not so governed. Thus, whilst a supply authority can only refuse to give a supply if certain conditions laid down in the Regulations are not fulfilled in respect of the installation, the owner is not bound by those Regulations and can insist upon much more onerous conditions being complied with before giving his consent, even though those conditions are quite unnecessary from the point of view of safety. An installation might even conform in all respects with the I.E.E. Regulations and thereby be deemed to satisfy all the requirements of the Commissioners and yet the Corporation would be entitled to refuse to give a supply. This may have the effect of depriving an occupier of his clear statutory rights. No doubt the Corporation feels that in view of the Court's decision it is justified in adopting its present attitude and one cannot, of course, blame it.

At the same time one is bound to express the hope that factors will not make use of the rights which this decision appears to have given them to impose unreasonable conditions on their tenants. Otherwise, some courageous consumer will be forced to challenge the decision of the High Court of Justiciary and take it to the ultimate court of appeal, the House of Lords. A decision of the Scottish Courts is, of course, not binding in England, but if the House of Lords upheld the view of the High Court of Justiciary then one may venture to suggest that the time would be ripe for some legislation to be introduced to remedy the situation.

New Uses of Welding. By C. W. Brett, M.I.W.E.*

Advantages of reduced cost, lightness and strength

IMPROVEMENTS in the technique and application of electric welding have been so rapid that fusive methods of repair and fabrication have penetrated into almost every branch of engineering. Recently the hulls of several sea-going vessels have been erected almost entirely with welded joints in place of riveting. Modifications in the rules governing welding practice in building construction have given a fillip to this class of work, while a large number of machines are being fabricated from heavy plate metal cut to shape and welded together. Not only is there a substantial gain in strength but also, and equally important, a reduction in weight compared with heavy castings.

The majority of press and stamping machine bodies lend themselves to construction by electric welding, and a large saving in the cost of manufacture results, for patterns are not necessary and there is no risk of the rejection of castings, probably after machining has been commenced.

In the motor car trade electric welding, particularly of the resistance variety, is being used to an increasing extent, the welding machines coming mainly under the sub-divisions of the spot, butt or seam type. In some cases welding is relied upon entirely, while in other instances it is used in conjunction with riveting for strengthening purposes, but in any event the relation of fusive methods of union to production cost is of great importance.

Great strides have also been made in the various branches of railway work, and worn rails, points and crossings are commonly built up by electric welding. The time saving alone which results from this procedure represents a substantial sum. Wear of railway track is not uniform and occurs mainly at the rail joints by reason of wheel impact; it is also emphasised at points and crossings, particularly when electric haulage is used, for impact is largely determined by the centre of gravity and this is generally low in the case of an electric locomotive or power bogey.

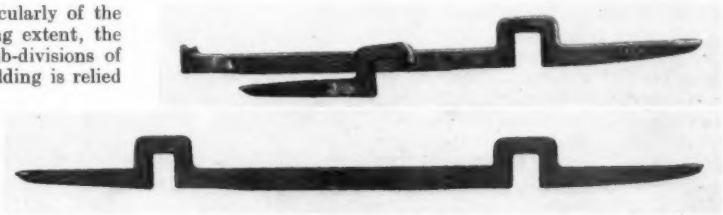
Eliminating Fish Plates

Welding is now being used to unite standard lengths of rail with a view to eliminating fish plates, as the degree of expansion and contraction which takes place in a long rail is not in proportion to that which occurs in shorter lengths. Rails of between 200 and 300 ft. in length, without any fish plate joints, have proved entirely satisfactory, and no trouble has arisen due to variation in atmospheric temperature. As a result of these experiments it is now proposed to have unbroken lengths of track in excess of these dimensions. It is not practicable to transport rails of great length; they are manufactured in standard lengths and then welded together just prior to being placed in position. This method also reduces wear due to the elimination of fish plate joints and results in much smoother running of trains.

All work of this character calls for the closest investigation into the physical properties of the material worked upon, and also the production of welding electrodes which are absolutely reliable. If the deposited metal is too hard, there is risk of surface cracks developing and spreading; if too soft, rapid wear will inevitably follow. It has been found beneficial to heat the rails to specific temperatures before the welding is begun; at the same time atmospheric conditions must be taken into consideration while the welding is in progress.

In Germany, resistance welding is reported to be employed for joining standard lengths of rail, but so far as I am aware manual welding only has hitherto been used in this country.

At the recent Shipping, Engineering and Machinery Exhibition an "all-welded" railway-wagon chassis was shown. The absence of brackets and angle pieces, which are necessary when riveting is employed, resulted in a noticeably clean appearance. In locomotive shops and running sheds the all-round reliability of electric welding and repair work has so engendered confidence that work is now being done which only a year or so ago would have been regarded as impracticable. Electric welding is also used by many railway companies in repairing and strengthening bridges, reinforcing plates being welded to the flanges and webs of bridge girders. This work is done without moving the girders and traffic is not interrupted, as is usually the case when new sections have to be fitted.



The broken side of a tramway truck, and (below) the same after it had been scientifically welded

There has been some reluctance to carry out welding operations for reconditioning coal-gas containers, for although there is no danger when the holders contain coal-gas alone, there is a risk of explosion if air is trapped in any part of the holder. However, this class of repair work and the precautions necessary are now well understood by the firms which undertake it.

Repairing Steel Frames

Steel frames are repaired as well as fabricated by electric welding, which has proved definitely successful whether applied to the light frames of small cars or to the heavy chassis members of the largest type of road transport vehicles. This class of repair should be undertaken only by specialists because it frequently involves the difficult work of straightening distorted frame members as well as uniting fractures in them.

The accompanying illustration shows (top) the broken side of a tramway truck belonging to a Corporation Transport Department in the Midlands. At a small fraction of the cost of a new one, and in less than 48 hours, it was repaired by scientific welding as shown below, its strength being quite adequate to carry the required load of eleven tons.

Experience is necessary to decide the correct electrode to use, where a job should be started, and the temperature of the parent metal before the welding is begun.

* Managing director, Barimar, Ltd.

London Telephone Progress in 1935

THE co-operation of the staff in the development of the service by acting as voluntary salesmen is commented upon in the 1935 progress report on the London telephone system issued by the General Post Office. During last year this co-operation resulted in 1,251 new installations, 2,482 telephone extensions, and 12,918 hand-microphone instruments and 2,774 miscellaneous items being ordered by subscribers in the area.

The number of telephones in the London area increased by 66,000 during the year to 938,000, representing an average weekly addition of 1,270. Traffic also expanded considerably, the total number of calls originated in the London area being 929 million (72 million more than in 1934).

There are now 250 exchanges in the area (85 automatic, 153 manual, five trunk, two toll, and five junction switching exchanges). In addition to the increased lines which were added to existing trunk routes, new direct routes were opened to Chester, Shrewsbury, Falmouth, Taunton, Grimsby, Truro and Leamington Spa, and direct routes will be made available shortly to Dundee, Perth and Carlisle.

The total number of effective inland trunk calls from subscribers in the London area last year was 5,761,000, as compared with 4,248,000 in 1934. Of that total 1,653,400 calls were dealt with between 7 p.m. and midnight. About 419,000 trunk calls were made from call boxes, an increase of 126 per cent., and over 760,000 Continental calls were handled by the international exchange. New trunk and toll directory inquiry equipment has just been provided to cater for subscribers who do not know the telephone number of the person to whom they wish to speak, over 1,700 such calls being dealt with daily. Approximately 320,000 test calls were made during the year. More than 3,246,000 telegrams were sent by the public from public kiosks, while delivery of 1,337,600 telegrams was effected directly to subscribers over their private telephones, thus speeding up delivery.

The growth of the service during the year necessitated an increase of 400 in the staff, bringing the number employed to 10,900. Employment was also provided for 700 additional engineering workmen. Nineteen new exchanges will be opened in the near future, and construction work commenced on twenty-seven buildings to house exchanges. Eight exchanges are to be enlarged.

The number of London-Paris circuits was increased from 37 to 42, and additional circuits between this country and Italy, Holland and Switzerland were also brought into use. Direct communication was established between London and Moscow, so that the total number of Anglo-Continental telephone circuits is now 138.

A new type of telephone (the "Astic") has been developed for use in noisy situations where difficulty in hearing cannot be overcome. It is also hoped to install "talking clocks" in London telephone exchanges early this year. The clock will be controlled by means of time signals from Greenwich Observatory and announcements will be given every ten seconds.

There are now about 10,000 call offices in the London area and the telephone directory contains over half a million entries. During 1935 approximately three million books were issued. Over four million miles of telephone lines are used for London's system, an increase of 200,000 miles over the total in 1934.

"Telex" subscribers now number 125, and the teleprinter service continues to expand. A new development is an installation whereby news can be transmitted simultaneously to a hundred subscribers; an example of this type of equipment has recently been installed in the office of one of the London newspapers.

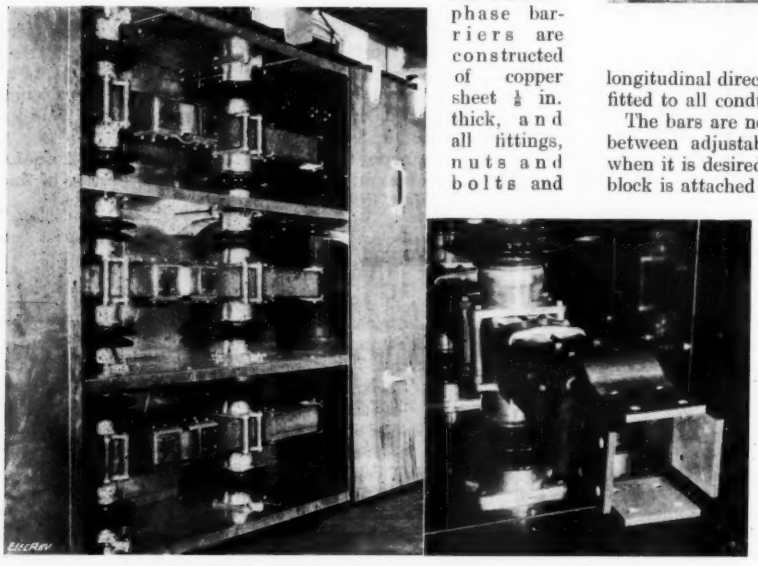
Copper Channel Bus-bars. By G. W. Preston, A.M.I.E.E.

Their use at Boulder Dam

THE disadvantages of large laminated bus-bar conductors composed of a number of flat bars for the purpose of carrying very heavy currents can be overcome to some extent by a suitable arrangement of the laminations, but the most economical solution may often be found in the adoption of some alternative form of construction. A comparatively new type of bar which is gaining in favour for heavy current work is the copper channel, which has been employed for important installations, particularly in America, among which are the 4,000-A 23-kV bus-bars installed in connection with the Boulder Dam hydro-electric scheme, where, incidentally, hollow copper conductors are employed for the main 290-kV overhead transmission lines.

Each phase conductor of the bus-bars is composed of two six-inch copper channels, which are held together to form a hollow square by means of copper clamps and bolts. These clamps are made from an extruded copper section and are fixed at short intervals along the channels to hold them rigidly together with a space between the edges of the flanges sufficient to allow free ventilation of the interior, thus enabling the internal surfaces of the conductors to be utilised for heat dissipation. The construction results in bars having great mechanical strength and rigidity with the copper so disposed as to be utilised with maximum efficiency, both in regard to "skin effect" and the dissipation of heat.

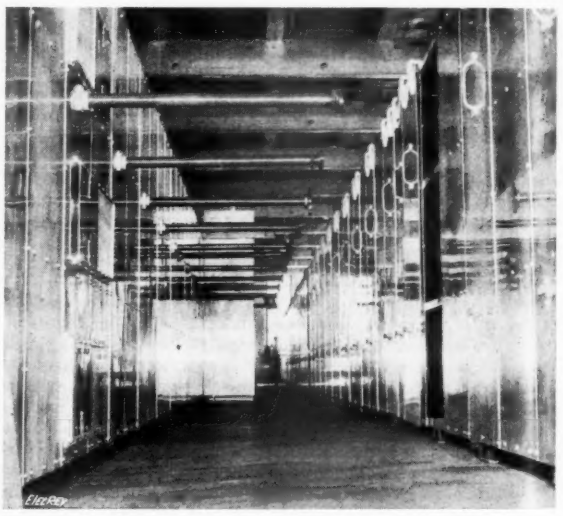
The three-phase conductors are arranged in vertical formation, each bar being supported above and below by porcelain insulators in such a way that the maximum strength of the structure is available to withstand short-circuit forces. A feature of the construction is that instead of the bars being supported, as is usually the case, by the structure of the surrounding housing, it is the latter which in this instance is supported by the bars and their insulators. Both the housing and the inter-phase barriers are constructed of copper sheet ⅛ in. thick, and all fittings, nuts and bolts and structural members are made entirely of copper or copper alloys, no magnetic material being employed for any part within the copper enclosures. The illustrations show part of the bus-bar enclosures and constructional details.



Details of laminated expansion joints

The two sections of the copper bus-bar enclosures shown in the course of erection have a total length of 250 ft. and are braced against heavy short-circuit stresses by means of the tubular members, shown protruding from the left-hand section. A removable door is provided opposite each set of supporting insulators to facilitate cleaning.

Whereas with the normal types of laminated bar lateral flexibility may be relied upon to accommodate an appreciable amount of thermal expansion, with an extremely rigid double channel bar, ample provision has to be made for the relief of thermal stresses by means of flexible joints and supporting clamps designed to allow a free movement of the bars in a longitudinal direction. Special copper-alloy locking washers are fitted to all conductor nuts and bolts.



Bus-bar enclosures

The bars are normally free to move at the points of support between adjustable eccentric copper-alloy spacing posts, but when it is desired to anchor the bars an extruded brass anchor block is attached to them and is held between the two spacing posts. The contact surfaces of all joints, whether rigid or flexible, are silver-plated. The end of the copper sheet housing for connnection directly to the side of an 82,500-kVA generator is shaped to conform with the curvature of the side of the machine and is reinforced by an extruded brass angle section. An intake ventilator is fitted in the side of the enclosure.

The three-phase bars and their housing run from the generator to the top of its oil circuit-breaker, the insulated terminal bushings of which extend into the housing through holes. Outlet ventilators in the end of each compartment of the housing are provided with adjustable covers which slide in guides made from an extruded brass section.

The heavy current bus-bar installation described illustrates the manner in which present-day copper manufacturing methods are coming to the assistance of the designer.

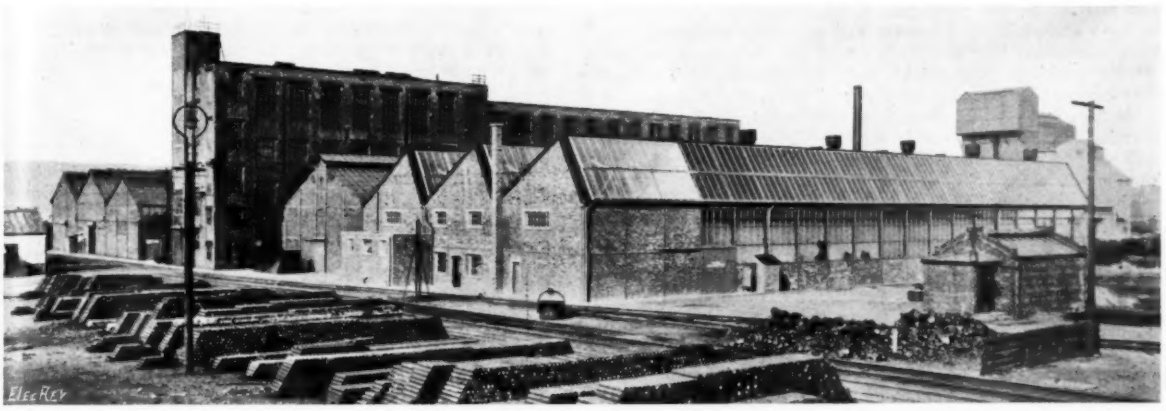
I am indebted for the above details and photographs to the Anaconda Copper Mining Company of New York and to the I-T-E Circuit Breaker Company of Philadelphia, which were responsible for carrying out the installation in which over 112 tons of copper and alloys were used.

Making Steam and Water Valves

How precision is secured at a Dumbarton factory

DURING a recent visit to the Dumbarton works of Messrs. Babcock & Wilcox, Ltd., we observed the amount of precision work that is entailed in the production of valves in sizes from ¼-in. to 16-in. bore for pressures from 10 lb. per square inch to over 2,000 lb. per square inch.

Valves are made in cast-iron, cast-steel, forged-steel and bronze, apart from a number of alloys used for various valve parts. There are cast-steel valves for temperatures above 840 deg. F., and for severe pressure-temperature conditions a special molybdenum alloy steel is used. Full advantage is taken of the excellent chemical, physical and metallurgical laboratories at Renfrew, where accurate control and testing during all processes is carried out and recorded. Steel forgings and die stampings are ordered from outside suppliers specialising in this type of work.

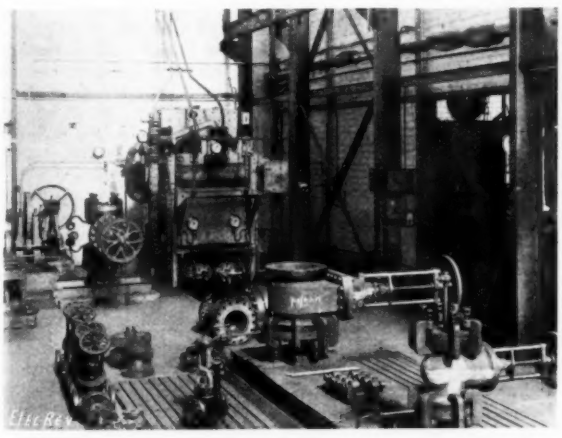


The B. & W. valve works at Dumbarton

In the non-ferrous foundry fourteen different alloys are regularly handled, and four of these are of the cupro-nickel series. Manufacture on the " quantity production system " entails the production of component parts in lots of from ten to five hundred, and the handling of assembly batches in lots of from ten to fifty. We would like to be able to describe the many interesting processes and very fine equipment we saw in such departments as the heavy and light machine shops, tool rooms and " Calorising " section, but we must content ourselves with a word about the methods of inspection and testing.

One-millionth of an Inch

A complete set of Johannsen gauge blocks, guaranteed accurate to below one-millionth of an inch, is the basis of all the working gauges. All component parts are inspected and gauged after every operation, not only by the machinist concerned, but also by the inspecting staff who use different gauges from those of the machinist. Every gauge is returned to the tool room after each job or stock order has been completed, and is carefully checked with master gauges before being put back into store for re-issue.



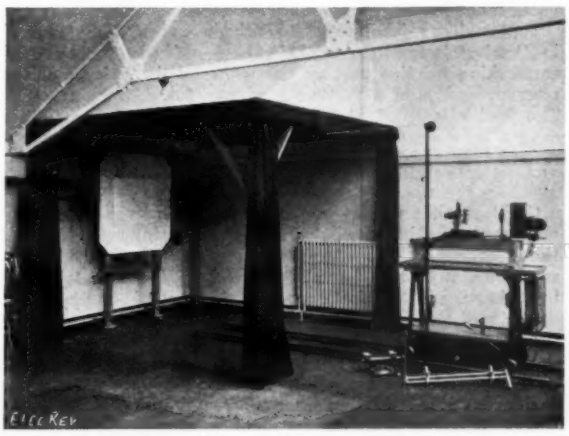
An oil-fired boiler for pressure testing at 2,000 lb./sq. in.

Of the special tools employed in gauging the following are of outstanding interest:—

A " Rockwell " machine measures hardness in terms of depth of penetration; this is an important point where metals are subject to abrasion, such as in valve seats and disc faces. The machine is essentially a commercial adaptation of the Brinell test equipment, and it can be used by an unskilled operator. It provides an excellent check on the heat treatment of such parts as expander mandrils and rollers, of which thousands are tested annually. The test is one of the routine inspections employed in the factory.

A comparator is used for checking, by means of the travel of a beam of light on a graduated scale, any inaccuracies of flat surfaces, or in diameter. If the beam of light travels from two to three inches this indicates an actual difference of from two- to three-thousandths of an inch on the object.

As nearly all screw threads in the factory are produced by the milling process an accurate means of comparative inspection of threads is essential; for this purpose projection apparatus is used in addition to the system of checking screw threads by three wires and micrometers. This apparatus projects an image of the screw thread, magnified fifty times, on to a screen. It is a simple and extremely accurate method of checking the form and pitch of the screw thread gauges, since an error of one-thousandth of an inch is shown as .05 in. By means of this apparatus gauges for special profiles can also be shown and accurately checked against an enlarged drawing of the actual profile.



Projection apparatus for comparative inspection of threads

No selection of parts is permitted during assembly. Valve bodies are subjected to a hydraulic test when a minimum amount of machining has been performed on them, so as to ensure that the castings are sound, before further or final machining is carried out. After assembly, the complete article is hydraulically tested and, if destined for steam service, tested under steam. Facilities are available for a hydraulic pressure of 3,000 lb. per sq. in., and steam pressures up to 2,000 lb. per sq. in. at 1,000 deg. F. The steam test is of particular importance for safety valves as it permits an accurate setting of the valve for the required release and closing pressures.

After testing, the gland packing is removed from the stuffing box of a valve and those valves for service in Great Britain are repacked immediately before shipment with new gland packing, whereas with valves destined for abroad the packing is shipped separately.

What E.R.A. is Doing

The fifteenth annual report

IN a foreword to the report of the British Electrical and Allied Industries Research Association for the year ended September last, Mr. C. P. Sparks, chairman of the Council, shows how the annual revenue of the Association has grown by £34,264 in the last five years to a total of £65,835. The sources were: £18,500 from Government Departments, £30,525 from the supply section of the electrical industry, £14,209 from manufacturers, and £2,601 unclassified.

The report records that continued support made important developments possible in several directions, although the available funds have not yet enabled the Council to bring into full activity all the researches which the industry has asked to have undertaken. Adequate and expensive equipment has been purchased for field work on surge phenomena and on circuit breaking. Research on radio interference, high voltage measurement, creep of metals and certain researches on dielectrics have been accelerated with good results, the researches on thermal transference coefficients in steam condensers and some other plant which have been in hand for a number of years being among those completed.

The Association had a technical staff of fifty-one and an administrative and clerical staff of thirty-three. In addition there were 461 voluntary workers on committees. During the year eighty-two new reports were issued to members, making a total of 623, each representing on an average an expenditure of about £700 by the Association.

Notwithstanding the expansion of activities, the Association had in hand at the beginning of the year further proposals presented for attention by the industry which would have cost a further £10,000 to finance. Of this sum the Government would have been willing to find £5,000 had the industry subscribed the other half. There is in fact a margin of at least £8,000 of Government money available in this way and only awaiting further support from the industry, and there is no reason to expect that such a favourable offer will be long continued.

During the year twenty-seven additional manufacturers agreed to subscribe to the Association, of whom eight were previously donors; thirty electricity supply authorities, including those in the Dominions and Colonies, agreed to subscribe, of which twelve were previously donors, and five others became donors.

The auxiliary laboratory at Perivale was officially opened in October last. Its completion and extension necessitated earmarking for this purpose the whole of the balance of the reserve fund, and a further sum was found from revenue. The final balance of £1,827 was carried over. Thus activities cannot be maintained unless an equal or increasing amount of new income is assured this year.

Ionisation Potentials

Oscillographic studies of dielectric current-voltage phenomena over the intermediate range of time intervals between those covered by indicating instruments and those involved in surge investigations have distinguished different types of breakdown, and "ionisation potentials" have been measured.

Study of the variation of thickness, power factor and permittivity of thin untreated papers (including condenser tissue down to 10 microns in thickness) has revealed the nature of a thickness/pressure relation and enabled electrodes to be designed for industrial measurements over a range of pressures. In addition to various methods of measuring thermal resistivity developed by E.R.A. a simple works test has been devised.

As part of a large-scale research on the calibration of the sphere-gap, organised by the International Electrotechnical Commission, new calibration tables which are thought to be accurate to ±3 per cent. up to 1,000 kV and a test plan have been issued by the E.R.A. The parallel-plate spark-gap designed by Dr. J. D. Stephenson presents itself as a promising alternative. Arrangements have been made for the completion of this work at Armstrong College, Newcastle-on-Tyne.

Arising out of Dr. Stephenson's work on discharges in gases, new fundamental laws were discovered. Amongst other things, it was found that the breakdown strengths of gases were related in a simple manner to their electron mean free paths. As it was felt that these phenomena held the clue to the causes of electrical breakdown of gases at normal temperatures and pressures, this work has been followed up under the direction of Prof. W. M. Thornton and satisfying progress has been recorded.

An effort is being made to frame two separate tests for dielectrics at radio frequencies, one concentrating on stress phenomena and the other on frequency. At the City and Guilds (Engineering) College a method has been devised for studying power-loss phenomena at low stresses, but at frequencies up to 50 million cycles per second. This has necessitated the design and construction of special loss-free condensers and resistors of a "purity" far in excess of those hitherto commercially obtainable. In the course of this work, contact-phenomena showed themselves to be of paramount importance, and a cathode-sputtering plant, with its associated technique, was developed to ensure that the electrodes were in intimate contact with the materials.

At Queen Mary College apparatus has been devised for equating the heat developed in a dielectric by high-voltage stresses (at about a million cycles per second) to controlled heat, locally generated, in a similar thermo-electric system. This enables the total watt-loss to be determined without a knowledge of power factor or permittivity, both of which will, of course, vary throughout the test owing to the rise in temperature.

Insulation Researches

A revised purchasing specification for insulating papers has been completed. The change in the viscosity of a solution of paper in cupra-ammonium due to heat treatment as a criterion of ageing is giving promising results, but the relative merits of two methods of heating paper have not yet been carried sufficiently far to enable conclusions to be drawn. Proposals for an air-drying varnish specification have been transmitted to the British Standards Institution. The development of an improved form of test for the detection of pinholes in enamelled wire has led to revised recommendations for carrying out this test. A machine is being tested in which enamelled wire is subjected to a specific abrasion test, the number of turns of a wheel being a measure of the resistance of the enamel to the action of a solvent. It has been ascertained that "ageing" of enamelled wire occurs when it is stored at atmospheric temperature for a considerable period (twelve months). This phenomenon has complicated the research at high temperature. The development of tests applicable to asbestos-covered magnet wires is in an advanced stage of completion.

New directions for the study of silk and rayon yarn, cloth, tape and braid for electrical purposes are in the hands of the printer. The research on the effect of chemicals upon silk has been completed, but owing to the closing down of the British Silk Research Association it has not been possible to complete the research on the light-fastness of dyes. All silk exported from Japan conforms to a certain arbitrary standard of quality. Also the International Silk Federation has issued a comprehensive specification which is applicable to all forms of raw and worked silk as a basis of the terms of purchase. As no useful purpose would be served by the preparation of further purchasing specifications for silk products by the E.R.A. at present this work has been brought to a close. Further work on the preparation of purchasing specifications for electrical rayon products has also been suspended, as there appears to be no further demand forthcoming from the industry.

At the request of the British Standards Institution the E.R.A. undertook to carry out the electrical tests required to provide data for use in the preparation of a B.S. Specification for rubber gloves for electrical purposes. One report has been issued and others will be available shortly.

The Heating of Buried Cables

In connection with the heating of buried cables further research on the thermal resistivity of clay soil has been carried out at Newcastle-on-Tyne by means of a cylinder 12 in. long by 3 in. diameter with lower end rounded, buried at depths of 6 ft. and 10 ft., the object being to ascertain if a cylinder were equally suitable as a sphere for the purposes. The values of thermal resistivity ($g=55$ and $g=51$ respectively) in thermal ohms per cm³ are of the same order as those obtained previously with spheres. No seasonal variation in thermal resistivity was found. The research is being continued at higher watt loadings to ascertain if drying out of the soil occurs at higher temperatures.

In sandy soil at Northfleet, Kent, two 9-in. spheres have been used, one at a depth of 3 ft. and one at 5 ft. below the surface, and, in addition, results have been obtained with a 3-in. sphere at a depth of 5 ft. Considerable variations in thermal resistivity have been noted at the greater depth with both spheres. These variations have a marked seasonal characteristic, but the value obtained at a depth of 3 ft. has remained reasonably constant over a period of one year.

Progress has been made in the computation of current ratings and recommendations have been made to the I.E.E. Wiring Regulations Committee on the ambient air-temperature and temperature rise to be adopted for the purpose of current rating tables, and the maximum permissible operating temperature of cables in buildings.

When cables are buried in multiple ducts leaving the cable

in the middle duct-way idle this does not materially increase the current-carrying capacity of the duct system as a whole, and the position of a single loaded cable in a nine-way duct system has but little effect upon its current rating, provided that all the other duct-ways are occupied by idle cables.

Data on cables in proximity to steelwork parallel to the run of the cables have already been incorporated in the I.E.E. Wiring Regulations. A further investigation to cover the passage of single-core cables through ferrous structures has shown the effect of the steel on the current rating of the cables to be negligible, but their impedance was increased. The most serious effect was, however, the heating of the steel itself, which under certain circumstances could reach a temperature such as 80 deg. C. Precautionary measures designed to overcome such troubles have been suggested.

The research on the wear and lubrication of railway contact wires and collectors on overhead line traction systems has been continued, and a material for the collector shoe has been discovered, consisting of copper with carbon as a lubricant, which shows a great improvement upon other materials tested.

Earth Resistances

Investigations have been completed on the voltage gradients around sub-stations and power stations, and recommendations made whereby telephone and other low-voltage cables may be protected from the voltage rise under fault conditions.

Considerable improvement has been made in the cathode-ray equipment for the laboratory study of phenomena at zero pause, and a unique device has been completed which enables cathode-ray oscillograms of each successive zero during arc rupture to be recorded on a *stationary* photographic plate, and 10 or 15 consecutive zeros can be clearly identified on one plate when this method is used. The time-scale is such that changes of potential taking place in one-millionth of a second may easily be read. Higher speeds can be obtained if required.

The circuit-breaker patents held by the E.R.A. have been maintained. Three new British applications were made during the year, and improved breakers embodying E.R.A. inventions are now in successful operation in this country. Important negotiations abroad in connection with E.R.A. patent licences were successfully completed during the year.

A subsidiary company, E.R.A. Patents, Ltd., completed important licence agreements which are bringing in and will bring in substantial income. Five companies now hold licences to manufacture electric control apparatus under E.R.A. patents.

Regarding telephone interference and multiple earthing an investigation with the co-operation of the Wessex Electricity Co. confirmed that neutral currents were normally small and would not be seriously increased by multiple earthing on modern systems, and also confirmed the theory proposed tentatively from previous tests as regards the source and propagation of neutral harmonics. Certain interesting phenomena appearing during the tests are to be further examined. There is some reduction of interference when the power circuit takes the form of a multi-conductor armoured cable.

Transmission Line Surges

The interference aspect of waveform distortion was realised to be of growing importance, and a definition of " telephone harmonic factor," which measures this feature, was prepared.

Earth resistivity maps, together covering the whole of Great Britain, published during the year are proving of great value in interference calculations and will have other applications.

The first batch of the improved klydonographs were installed in November, 1934, while by the end of the year there were twelve of these instruments available for use. The cathode-ray oscillograph for recording uncontrolled transients, mounted on a trailer, was installed on a 132-kV line of the " grid " system.

The impulse generator, required for the investigation of the phenomena associated with the propagation of surges on overhead lines, will probably commence work early this year on a 33-kV overhead line nearing completion, but will not be required for service immediately. For recording purposes it is intended to use the transportable cathode-ray oscillograph equipment referred to above.

The research on the relation between the orientation of sapphire meter jewels both natural and synthetic and their resistance to wear has shown that jewels cut with an optic axial angle approaching 90 deg. give minimum wear when the bearing is run dry. Since, however, it is now usual to lubricate meter bearings, further investigations are being made to see how far the effect of orientation is affected by lubrication.

Distribution Efficiency. By H. Hurworth

An important factor in electrical development

THE distribution system of an electricity supply undertaking as the link between the generating station and the consumer is the target for criticisms from both ends. In the mind of the generating engineer it restricts load development by its heavy financial burden, while on the other hand it is the subject of attack by consumers who consider their supply either poor or unreliable.

Although opposed to one another, both criticisms originate from a desire to improve the service which can be provided by electricity; consequently the standard of efficiency achieved by a distribution system is a measure of its ability to overcome these criticisms by providing a supply good enough to satisfy the desires of any reasonable consumer and, at the same time, capable of progressive but unlimited development at a reasonable cost. A good supply possesses two features, namely, high quality and reliability.

Question of Quality

Quality in electricity distribution requires the consumers' voltage and wave-form to be maintained as near to the declared values as possible, and new schemes should aim at the maintenance of a high standard of quality rather than economic balance during the preliminary stages. If the quality of the supply is above reproach, a correct sales policy will enable development to be sufficiently rapid to attain an economic balance in a reasonably short time, whereas a sales campaign is strangled before its inception by a poor supply.

Even at the present time development of large potential uses of electricity is prohibited by cost, and every endeavour should be made to extend the sales in existing fields to enable the price to be reduced sufficiently to attract these sources of revenue.

One of the best sales arguments is the ease with which electricity can be harnessed to perform everyday tasks in an efficient manner and the ability to do this mainly depends on the quality of the supply. If a considerable improvement in quality can be obtained by slightly increasing distribution expenditure, any addition will be economically justified by the increase in revenue due to accelerated development. This is confirmed by the opinion of many engineers that to ensure good voltage regulation at the heavy load densities predicted in the future, reversion to high-voltage services and house transformers will be necessary. Although this method has several serious objections, the trend is towards a reduction in the length of low-voltage distributors by the introduction of more transforming points.

During the last few years the necessity for improvements in the voltage regulation of rapidly expanding distribution systems has compelled the adoption of higher distribution voltages, and improvements in design have enabled this to be done without appreciable loss of reliability. The natural result of this development has been the introduction of higher transmission voltages, but this has not proved quite so advantageous, because the resulting increase of the system rupturing capacity has compelled careful sectionalisation, which has done much to counteract the anticipated improvement and forced the engineer to adopt other methods.

The variety of methods devised for controlling the voltage under load proves that the need for good voltage regulation is becoming more generally realised, and the greater demand for such apparatus has directed progress towards reductions in cost and improvements in reliability. The latter has reached a standard high enough to make desirable the adoption of voltage control for the transmission systems of all large undertakings, but considerable reductions in cost are necessary before such equipment can be economically justified for general use at low voltages.

The electricity supply industry must look to the general public for its greatest potential field. Until electrical appliances are considered a necessity, the urge of the general public to purchase them (like all luxuries) will be impulsive. A number of circumstances may be responsible for such an impulse. A sudden snap of cold weather may cause several consumers to change vague ideas " of trying electric heating sometime " into decisions to buy radiators. If the distribution system cannot adequately supply this sudden demand, the adverse effect on development will be very difficult to counteract. The development of an efficient distribution system is, therefore, always slightly ahead of the immediate maximum requirements and consequently advantage can be taken of any special circumstances to increase sales. This does not imply that a system required for a 100-kVA load should be large

Meetings and Discussions

Electrolysis by Sea Water
Seven-inch Radio Waves
The Design of Small Motors

The Corrosion of Ships' Hulls

THE paper by Mr. W. E. LEWIS which was read before the NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS at Newcastle-on-Tyne, January 24th, deals with the protection of ships' hulls against sea-water corrosion, the occurrence of which is based upon the fundamental principles underlying the generally accepted electro-chemical theory. The immersion of solid conductors, either metallic or non-metallic, in a liquid capable of conducting electricity induces an electrical potential on the immersed surface of each conductor which varies in intensity with the chemical or physical nature of the body. When the conductors differ in their chemical compositions or physical states contact between them results in a flow of electrical energy from the immersed surface of highest potential, through the liquid, to the surface of lowest potential, the circuit being closed through the points of contact. This electrical energy results from the corrosion of the conductor of the highest potential.

If, therefore, a steel vessel is fitted with brass (or bronze) propellers, immersion in sea water induces a difference of potential between the two metals, that upon the steel being the higher. Electrical energy passes from the steel and the hull structure corrodes.

It is found, however, that if a zinc slab be fixed in electrical contact with the steel surface, the difference in potential between the zinc and the brass will be greater than that between the steel and the brass. Under such conditions the electrical energy will emerge from the submerged surface of the zinc slab, and the steel structure will be protected against corrosion at the expense of the renewable zinc. To obtain the maximum benefit from such a protective measure the zinc slabs should be attached to the hull structure at those points where maximum corrosion usually occurs.

The resistance of ferrous material to corrosion can be increased by metallurgical alloying, but the method is uneconomical at present, and complete immunity is not obtainable thereby. The most suitable and economic method of protection against this electrolytic action is to insulate the ship's hull from the sea water.

Based upon his own experimental investigations, the author submits that the only efficient way of inhibiting this action is to descale the structural material before constructing the hull and so eliminate permanently this stimulus to corrosion. Pickling, sand-blasting, or other means of descaling add nothing to the resistance of the structure. They simply ensure that the primary coat of paint comes into direct contact with the metallic surface which it is desired to protect. The one criterion of a protective paint is impermeability to sea water. It is essential that each coat of paint should adhere closely to the underlying coat and to the metal surface, to prevent water seeping through or between them.

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Micro-ray Communication

EXTREMELY short-wave radio telephone and telegraph communication is discussed in the paper by Messrs. W. L. MACPHERSON and E. H. ULLRICH (put forward by the Wireless Section) which was read at the INSTITUTION OF ELECTRICAL ENGINEERS in London on January 30th. The method of generating and modulating micro-waves about 17 cm. long with a tube (valve) having two grid lead-outs is discussed, and it is argued that the grid itself becomes a transmission line of negative leakance.

The smallness of the power that is needed is not necessarily a disadvantage, since at any short-wave lengths large-gain radiation systems can be used. Directive aerial systems using focusing paraboloidal and hemispherical mirrors and echelon gratings are described, as well as experiments with ebonite lenses and zone plates.

A big step forward was made in March, 1931, when the first large-scale public demonstration of modern micro-ray working was given by Standard Telephones and Cables, Ltd., and Le Matériel Téléphonique in France, over a duplex radio-telephone link across the English Channel. The terminals of the link were at St. Margaret's Bay, near Dover, and at Escalles, near Calais, the distance between the two being approximately 35 km. A wavelength of 18 cm. was used, sufficiently short to permit the use of a highly directive radiating system designed almost on optical lines and embodying the use of aperiodic reflecting mirrors instead of the customary tuned reflecting aerials spaced so as to give a directional bias to the radiated field. A second installation is a commercial link connecting the aerodromes at Lympne and St. Inglevert.

The equipment used for these installations is described and propagation measurements are detailed to show that, although there is an optical path in each case, severe fading, varying with the wavelength, sometimes takes place. This fading is attributed to an interference pattern which varies with atmospheric and tidal changes. The directivity and gain of paraboloidal mirrors and echelon gratings, as determined by experiment, are given.

The results of the two links described are that the most stable micro-ray conditions coincide with very stable atmospheric conditions, as judged by thermometer and barometer. Given stability of temperature and pressure, the actual values seem to have no importance and rain, hail, snow, or fog do not affect the link.

No definite relation between the electrical state of the atmosphere (potential gradient) and micro-ray stability has been found. Excellent operation has been obtained during thundery periods, but there is no information as to the general atmospheric stability at the time. A high wind is almost invariably accompanied by good micro-ray transmission.

Sudden changes in temperature are usually accompanied by micro-ray fading; likewise, sudden barometric changes. Rapid fluctuations in temperature occur much more frequently on

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Distribution Efficiency. *(Continued from preceding page)*

enough for 1,000 kVA, but nevertheless it should be designed to enable such provision to be made if required at some future date.

The relative importance of economic limitations on the quality and reliability of distribution systems is debatable. As a general rule both factors are assumed to be of equal importance, although it would be interesting to hear the opinions of distribution engineers on this subject which, in view of the present rapid rate of development, is of considerable importance.

A great deal must depend on the type of load which is connected, and, although a supply of high quality is essential for most purposes, reliability is generally of more importance to industrial than to domestic users. Fortunately, this is counterbalanced by the lower distribution costs of an industrial supply due to the concentrated load, which permits a greater expenditure on reliability without a corresponding increase in the cost per kWh. In spite of economic limitations considerable improvements in reliability are frequently possible by simplifying the design, and by the elimination of all items which may be classified as luxuries, although generally included by the dictates of custom.

The design of the protective scheme will have a considerable effect on reliability. Its primary function is to guard the general supply from the effects of faults on the system it controls and, although this object must be the first consideration, it should not seriously reduce the reliability of its own local system by light settings and consequent unstable operation. Reliability will also be adversely effected by providing too many protective points and consequently increasing the possibilities of inadvertent operation by introducing an unnecessary number of instabilities.

Finally, in choosing the type of protective equipment some consideration must be given to the cost of maintenance. It is futile to provide expensive switchgear and protective relays unless provision is also made to maintain them in an efficient working condition.

If such provision cannot be made, far more reliable results will be obtained from simpler protective devices such as fuses, which require less expenditure on maintenance. It must be emphasised, however, that the economic cost of supply, although having a considerable bearing on the standard of service provided, must not be unduly stressed during the early stages of development of a new system, otherwise the ultimate financial success cannot attain the highest possible standard.

hot days than on cold days; fading is much more pronounced during the summer months than in winter. The settling of a heavy bank of fog has been accompanied by very severe and rapid fading, followed by stability when the fog bank has ceased to move.

During summer extremely violent fades of very short duration (1 to 2 minutes) have been noticed, and fading at audio-frequency seems to occur both in broad daylight and in darkness. Ultra-short waves of 6 m. length are much stabler than micro-rays over optical paths across the Straits of Dover. In noisy locations, micro-rays have the advantage over ultra-short waves of being much less affected by "man-made static." Micro-ray communication is much more private than with ultra-short waves between 100 cm. and 10 m. Micro-rays are the beginning of a new, and as yet almost entirely unexplored, region of the frequency spectrum. The particular feature of micro-ray technique which stands out is the sharp three-dimensional directivity which is made possible by the use of reflecting systems designed according to the laws of optics and very small compared with ordinary aerial systems.

* * *

Small Motors

IN opening a discussion on "Small Motors" at the informal meeting of the INSTITUTION OF ELECTRICAL ENGINEERS in London on January 20th, Mr. R. A. LOCHNER dealt with machines ranging from ¼ to 10 h.p., for which in recent years there had been such a phenomenal increase in demand. This was due to (*a*) rapid extension of the single drive, eliminating shafting; (*b*) many more operations now being performed mechanically; and (*c*) increase in the number and size of secondary industries in the home market. It was estimated that the total production of small motors in this country had now reached a total of 200,000 per annum.

The general adoption in the past ten years of ball or roller bearings had assisted the designer to improve the efficiency, power factor and reliability of induction motors of 1 h.p. upwards very considerably.

The author said that at one time it appeared that the repulsion-induction motor would hold the field, but recent developments had produced the capacitor type of machine which had so many characteristics to recommend it. Mr. Lochner described the design of these machines, and by means of lantern slides showed remarkable performance and efficiency curves for the capacitor motor in various applications.

It was stated in the discussion that those making repulsion-induction motors need not feel that they had been superseded, for there were defects in the capacitor type that the introductory remarks had not brought out. When installed in numbers they were liable to become an embarrassment to the supply engineer, whose attitude towards small motors in general was too often quite incomprehensible.

Another speaker said he believed that the capacitor motor originated in the United States and next reached Germany, and its success in those countries was due to the low voltages prevailing there. With the increased voltage in Germany, the chemists had been unable to produce an electrolytic condenser to meet the new conditions, although research in England had apparently been successful; he was glad to have Mr. Lochner's assurance that capacitor motors had condensers that could be fully guaranteed.

* * *

Exhaust Steam Marine Propulsion

THERMODYNAMIC aspects of the interposition of an exhaust steam turbine between the low-pressure cylinder and the condenser for marine propulsion are examined in the paper by DR. J. B. O. SNEEDEN which was read before the INSTITUTION OF MECHANICAL ENGINEERS in London on January 24th. So far four systems have been designed for turbine combustion plant, namely, mechanical, electrical or heat-coupling, and heat regeneration.

Two means of electrical coupling, similar in their basic principle, but different in their application, have so far been constructed. In the Metropolitan-Vickers system the electric generator is driven by the exhaust turbine through single-reduction gearing and the current supplied to the propelling motor, which is fitted direct to the propeller-shaft. During manœuvring the additional propelling machinery reverses with the engine. Further, in some cases a live steam connection to the turbine is provided, so as to render the auxiliary power available in case of the breakdown of the main engines.

In the British Thomson-Houston system the generators are directly driven by the exhaust turbines, and the propelling motor is fitted, as in the previous case, to the propelling machinery just aft of the thrust blocks. As each alternator is directly connected to a propelling motor, the additional propelling machinery cannot remain in commission during reversing and manœuvring. The controls are interlocked in order that the motors may operate only when the reversing gear is in the ahead position. A live-steam connection to the turbine is provided, as in some of the Metropolitan-Vickers installations.

Since the efficiency of the various stages of energy transformation is very high in this arrangement, the overall efficiency from turbine-shaft to the propeller-shaft will again be about 92 per cent. and it is possible to assume that the additional indicated horse-power available for power purposes will be almost equal to that obtaining with mechanical couplings. Hence the saving in heat consumption per indicated horse-power-hour will be approximately 22 per cent.; with steam extraction at the low-pressure exhaust, 23.5 per cent.; and with further steam extraction at the intermediate-pressure steam chest, 24.5 per cent.

Some additional economies may be obtained in this system by the substitution of electric drives for all the auxiliaries, at the expense of a rearrangement of the turbo-electric units, since during manœuvring the turbine will be required to generate sufficient current to feed the auxiliary motors. Operating results for the *City of Hong Kong*, fitted with the Metropolitan-Vickers system, are given in the paper.

In the Lindholmen regenerative system, as installed in *S.S. Trione* in 1931, the energy from the exhaust turbine is first transformed into electrical energy. Part of this is used to drive the auxiliary and the surplus is utilised for electrically superheating the steam supply. Thus the turbine energy is partly expended directly and partly in the form of heat regeneration at constant pressure, and therefore the saving actually realised is intermediate between that due to the first (mechanical coupling) group and zero. This recuperation of exhaust heat will not be available when the auxiliaries are electrically driven. The alternative arrangement of electrically driven auxiliaries and feed heating by extraction from the receivers would be better thermodynamically.

* * *

Voice-frequency Telegraphy

The system of multi-channel voice-frequency telegraphy used by the G.P.O. is described in the paper by Mr. A. WILCOCK which was read before the London Students' Section of the INSTITUTION OF ELECTRICAL ENGINEERS on January 29th. The type of line over which the system is designed to work is fully described as is also the equipment constituting a voice-frequency telegraph terminal, and the power requirements for maintaining it are stated. The basic principles of the "telegraph distortion measuring set," which is an adaptation of the cathode-ray tube, and is used for maintaining the equipment, are given, and the types of signal distortion met with in voice-frequency telegraphy are enumerated. In conclusion, a description is given of a new type of "all mains" equipment, of a reasonably portable nature, based on the principles of the older equipment, and suitable for special-event work.

Motor Car Electrical Equipment

An illustrated lecture was delivered in London on January 27th to members of the SOCIETY OF AUTOMOTIVE ELECTRICAL ENGINEERS and representatives of the motor trade by Mr. D. PRYKE, of the Dynamo Research Department of Simms Motor Units, Ltd. In the course of his address Mr. Pryke dealt with the operation and "servicing" of lighting and starting equipment, as applied to passenger and commercial vehicle systems. It was intended to make the lecture as comprehensive as possible and the speaker attempted, therefore, to cover all the well-known equipments, explaining, in addition to their operation, acknowledged systems for the rapid location of faults and accepted methods of "servicing."

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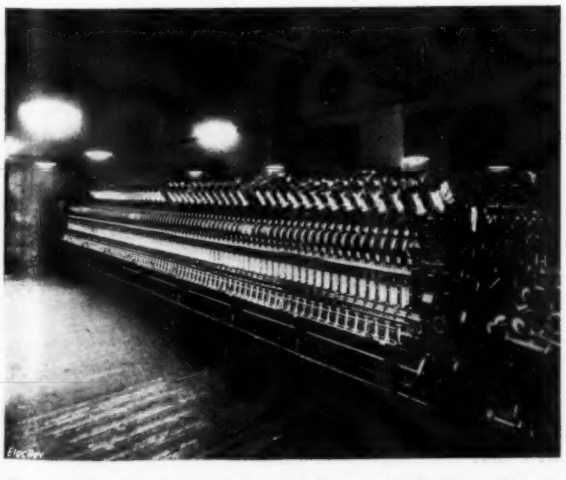


This good example of loom lighting is installed at Messrs. Paton & Baldwin's, Alloa. It employs "Osram" lamps in dispersive reflectors

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Qualifications for Works Management

May I ask the assistance of some reader on the following matter? Having read with interest the letters and articles which have recently appeared on the commercial requirements of an engineer, I shall be grateful to anyone who will tell me what qualification a works manager would look for in appointing an assistant. What additional experience or qualifications would be expected of an engineer applying for the post of assistant manager to a works employing, say, 500 persons, given that his qualifications were: Age, 28 years; Grad. I.E.E.; comprehensive experience including workshop, test room, drawing office, experimental or chemical lab., outside installation and maintenance and some sales?

Would a pass in the examinations of the Institute of Cost and Works Accountants, which include bookkeeping and accounts, factory and office organisation, costing and production methods, be the key to the problem? R. A. B.

January 26th.

Electricity in a New House

The closing paragraph of Mr. S. Allford-Harding's letter clearly indicates his opinion of engineers in business matters. Although I am only one of those engineers whose time is now mainly occupied in commercial administration, I simply must call attention to the failure of his comparison between the costs for his own house and those for the hypothetical one that he cites. If his tariff is 12½ per cent. per annum of the net rateable value (£2 2s.) plus ½d. per kWh, the annual cost for his hypothetical house, which I assume would have the same r.v. and is in the same area, is as follows:—

	£ s. d.
Fixed charge	2 2 0
3,278 kWh at ½d.	6 16 7
Total	£8 18 7

That is only 0.65375d. per kWh overall and is therefore only about one-half of Mr. Allford-Harding's finding.

In conclusion, writing as an engineer with a little commercial knowledge, I must draw attention to the poor business outlook of one who in public will (a) admire his competitor's goods and (b) run down his own product. Surely a good business man would act like Brer Rabbit and "lie low." I trust that he will forgive an engineer calling these matters to his attention. W. PHOENIX.

Newton-le-Willows, *January 27th.*

Mr. Allford-Harding works out the cost of electricity in an all-electric house at £20 12s. 7d. per annum. He says that it is fair to take a rate of 1¼d. per kWh, as his own bills average 1.32d. per kWh on a two-part tariff.

The tariff is stated to be £2 2s. per annum fixed charge plus ½d. per kWh, and one can calculate that Mr. Harding's consumption is 615 kWh per annum. He makes his example of an all-electric house use 3,278 kWh, and the cost on his tariff would therefore be £8 18s. 7d. This is very different from £20 12s. 7d.

Mr. Harding tells us that engineers should leave the financial side of electricity undertakings to commercial men. In view of his failure to understand a simple commercial tariff, one must suppose that Mr. Harding is also a

January 24th. MERE ENGINEER.

[In fairness to Mr. Allford-Harding we ought to state that the consumption for the all-electric house should be increased by 683 kWh for heating water for general purposes, this figure having been inadvertently omitted from the table, although the cost was included. "Mere Engineer's" total cost should therefore be increased to £10 7s., but this does not invalidate his argument.—EDS. ELEC. REV.]

Electricity and Process Steam

We have read with interest the article that appeared in your issue of January 10th, and, as makers of steam engines for generating sets, the exhaust steam from which is used for general heating (including that of buildings), hot water systems or process work, it appears to us somewhat sweeping to describe as "a fallacy" the view that electricity generated in such system is a by-product and produced at no cost. This may be an exaggeration, but it does not dispose of the advantage of the combination, the value of which must be determined in each particular case.

We do not think that the system of generation of electricity by steam from the boilers in private factories, combined with the utilisation of the exhaust steam, can be swept aside in this summary manner, having in view the very large number of plants of this kind at work, and the continued expansion of the application of exhaust steam. We cannot agree that the lb. of steam per kWh when exhausting to atmosphere is several times that required when working with the same unit but exhausting into a condenser, and a casual reference to any steam consumption tables would confirm this statement.

We have for many years generated our own electricity for all the power and lighting of the works and offices, and, for a period of six or seven months in the year, the whole of the steam required is condensed in heating the buildings, and a small amount for feed water heating. The estimated minimum amount of steam thus consumed is about 2,000 lb. per hour, and if exhaust steam were not used, an equivalent heating system would be required.

On a basis of heat utilisation value, the use of exhaust steam hardly requires any defence, as out of the total heat of the steam supplied to any engine the amount which can be used for converting into energy in the engine is so small a proportion compared with that which must be rejected to atmosphere or condenser. Also, in the latter case, a complete condensing plant is required to obtain the extra efficiency. The respective proportions can be seen from any steam-engine tests and analysis of heat efficiency. W. SISSON AND CO., LTD.

H. S. Sisson,

Gloucester, *January 22nd.* *Managing Director.*

A Bakelite Fire

In the "New Apparatus and Devices" section of your last week's issue there appeared details of an appliance that has considerable significance—a fire in which the amount of metal is much smaller than usual. The protagonists of metal-clad apparatus have often pointed to the metal-encased electric fire and (with considerable sarcasm) invited the "all-insulated fanatics" to design a non-metal one. The challenge has been accepted, and although metal (apart from the conducting and immediate parts) is not entirely absent, it appears that there is no metal which can be grasped or which could readily cause risk.

One hopes that manufacturers will be encouraged to "all-insulate" many more domestic appliances in such a manner that earthing (as now understood and considered imperative) may be rendered unnecessary. And it should be remarked that, apart from considerations of safety, bakelite and the like appliances can be pleasing in the æsthetic sense and can remain so long after metal devices have discoloured and corroded. G. E. MOORE.

Sunderland, *January 27th.*

D.C. Voltage

I believe that it was suggested in the ELECTRICAL REVIEW some years ago that the symbol for current in the above should be eliminated. This left:—

D. voltage (direct) or
C. voltage (continuous) and
A. voltage (alternating).

These terms appear to be quite clear. W. E. PRITCHARD.

Leeds, *January 27th.*

Domestic Appliance Progress

Returns for the quarter ended September 30th last compiled by the British Electrical Development Association from information received from 264 electricity supply authorities, provide a useful indication of steady increase in popularity of various classes of domestic electrical appliances. During the period mentioned 28,519 additional cookers were installed, bringing the total up to 417,963, 366,712 (24,095 increase) being of the ordinary type, 18,377 (2,138 increase) of the breakfast type, and the remainder unspecified. There was an advance from 61,939 to 67,338 in the number of wash-boilers in use, while the number of water heaters installed rose by 13,786 to 123,069, this total including the following.—Immersion type, 40,582 (6,335 increase); self-contained, 1-5 gal., 33,329 (4,149 increase); self-contained, over 5 gal., 17,219 (931 increase). Ordinary domestic consumers numbered 2,565,099 (80,881 increase), and assisted wiring consumers 1,003,115 (26,757 increase), making a total, with others not classified, of 3,758,819 (108,521 increase). The above statistics relate only to 264 of the 650 electricity supply undertakings in Great Britain, and furthermore, that the totals given are not strictly comparable, owing to some of the returns being incomplete and not distinguishing between the various classification of water heaters and cookers.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

A Small Washing Machine

An electric washing machine approximately half the size and half the price of the usual apparatus, is expected by its makers, the WASHBURY CORPORATION, LTD., 237/239, Oxford Street, London, W.1, to find a ready market for use in modern flats and small houses where space is a consideration. It weighs only 28 lb., measures 16 in. in diameter and 28 in. high overall. Being mounted on castors, it can be easily slipped under the draining board or the kitchen table. A table incorporating a hand wringer which folds underneath is supplied as an accessory.

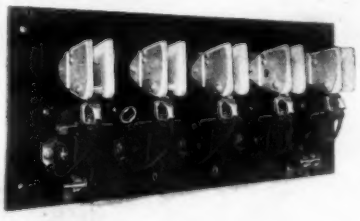
The "Washbury" washing machine

The machine will wash 4-5 lb. of dry clothes in 6-8 minutes. An attractive feature is the low loading of the motor ($\frac{1}{8}$ h.p.), which is totally enclosed in the base. A specially designed agitator with four fins is employed, there being only one central oiling point. For ventilation there is a fan with louvres in the base-plate, while rubber mounting reduces operating noises.

Heat-resisting vitreous green enamel is used for the body of the machine, the two handles and the four legs being black. A length of hose is provided for emptying the machine, and this can be clipped on to the handle when not in use.

D.C. Contactors

A range of d.c. contactors suitable for currents from 10 A to 150 A single- and double-pole has been put on the market by the DONOVAN ELECTRICAL CO., LTD., 46, Great Charles Street, Birmingham, 3. Arc shields and blow-outs are fitted on all sizes. Special points of design are ease of renewal of contacts and the use of a bigger air break than usual. There is a large bearing surface for the armature pivot, and the standard contacts are of copper, but silver-faced ones can be fitted for application where the contacts remain closed continuously for periods of about six hours. The contacts and coil are very easily renewed.



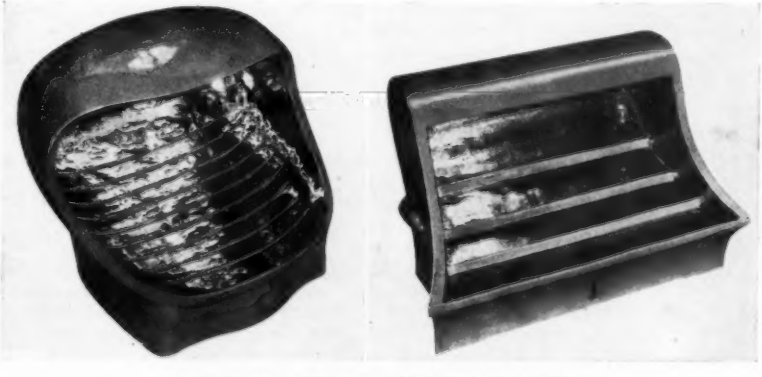
Donovan 80-A d.c. contactors

All-insulated Fires

As a result of many years' experience in electric furnace manufacture MESSRS. R. M. CATTERSON-SMITH, Adams Bridge Works, Wembley, a short time ago introduced a fire of unique design. The body was made entirely of moulded clay and was therefore non-conducting. Several improvements have been made recently, and we publish herewith photographs of two of the latest 2-kW models which we examined at the company's works recently. It will be noticed that the elements are completely concealed and protected from dust. The fires can be supplied in almost any colour, the reflecting surfaces being coated thinly with gold or platinum.

The "Kanthal" aluminium-steel alloy elements employed operate at a temperature of about 1,050 deg. C.—considerably higher than the more usual nichrome type, and as a consequence provide a greater proportion of radiant heat. They are set in a compound of "Siliconester" and dry "Sillimanite" powder and, in the case of the new 2-kW models, have aluminium ends which are slotted into heat-resisting "Staybrite" steel holders. Bakelite is used for the switch dollies.

The fires are very robust in construction, and the makers have successfully broken away from conventional designs. Slots in the sides are provided for lifting.



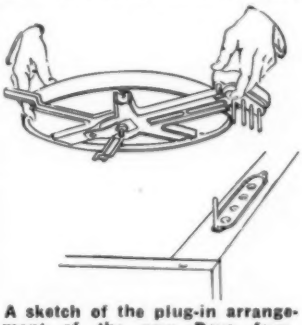
Two of the new 2-kW Catterson-Smith fires

Surface Hardening

Improvements in the Shorter "Double-Duro" process, which has been introduced into Great Britain by the SHORTER PROCESS CO., LTD., Celtic Works, Savile Street East, Sheffield, 4, have, it is claimed, enabled an entirely uniform depth and regular hardness to be given to the whole surface of the metal treated. The process is designed to ensure the maintenance of the full physical properties of the core while varying the depth of treatment to suit any requirement in gradual transition from the hardened exterior minerals. It is applicable to gears, cams, crankshafts, pins, journals and all frictional parts that are cylindrical in form, and can be readily incorporated in mass-production systems.

A Four-heat Boiling Plate

A boiling plate with a heavy loading for rapid operation as well as a low loading for simmering is announced by the REVO ELECTRIC CO., LTD., Tipton, Staffs. Altogether four distinct heats are provided, controlled by a patented fine-point switch. The entire surface of the plate is covered by three resistors, made of a specially selected grade of alloy. These lie in three separate grooves, an arrangement that is conducive to uniform temperature distribution over the surface of the plate. This feature, in turn, reduces the risk of distortion, which is a major consideration when a high loading is employed. To minimise the operating temperature of the resistors careful attention has been given to the thermal conductivity of the refractory material used. Similarly, a special cast alloy external casing has been evolved to combine a good factor of safety with freedom from rusting and scaling at high temperatures.



A sketch of the plug-in arrangement of the new Revo four-heat plate

In the "high" position the four-heat, five-position switch connects the three resistors in parallel, the loading being 2,250 W (8 in. diameter plate). In the "medium" position two resistors only are connected in parallel, the loading then being 1,500 W, which is unusual but useful when very rapid boiling would tend to burn the contents of the utensil. In the "low" position one spiral alone is in circuit, providing a loading of 750 W. In the "simmering" position, all three spirals are connected in series, thus giving the exceptionally small loading of 250 W.

With the switch in the "high" position (a maximum loading of 2,250 W) and using an aluminium kettle with a machined bottom, the boiling times (with an initial water temperature of 60 deg. F. and an ambient temperature of 58 deg. F.) are as follows:—0.5 pint, 3 min. 20 sec.; one pint, 4 min. 15 sec.; 1.5 pints, 5 min. 5 sec.; 2 pints, 5 min. 55 sec.; 2.5 pints, 6 min. 36 sec.; and 3 pints, 7 min. 20 sec. The efficiency curve of the new plate is very much in line with that of the standard type.

Regarding interchangeability, on account of the additional spiral an extra pin is required in the plug-in arrangement. In order to fit the plate to an existing cooker one of the screws securing the plug-in china has to be removed and in its place is fitted a pin with the dual purpose of providing an earth

contact pin with the upper portion and securing the china with the lower portion. The corresponding earth socket is housed in the cradle which carries the simmering plate. The four-heat switch is exactly interchangeable, both in respect of fixing arrangement and dimensions, with a three-heat switch. Thus the conversion of an existing cooker is straightforward. Production models incorporate the same earthing arrangements and are thus interchangeable.

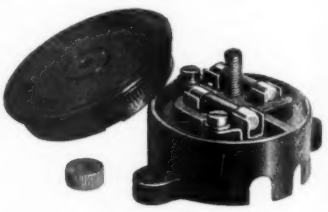
No complication arises from the use of a different cradle, which is necessary to house the increased number of leads, since its overall dimensions have been kept within the limits imposed by the former cradle. Incidentally, this cradle is of particularly neat design and houses all the six end leads in cast channels of spider formation, giving ample protection to each. There is a substantial earth bonding strip.

Wiring Accessories

A recently published list of "Efesca" wiring accessories includes approximately a hundred additions to the equipment sold by MESSRS. FALK, STADELMANN & CO., LTD., 83/93, Farringdon Road, London, E.C.1. There are shockproof switch, porcelain, and angle shockproof lampholders. Among the switches are new panel types, the "Ace" sunk, surface and semi-recessed types and a large range of "Pearlette" multiple units, as well as switch-sockets with angle entry. In addition, there is a wide range of switchgear, including ironclad and all-insulated equipment, cooker control units and a list of conduit fittings and cable junction boxes. "Sunstar" mirror reflectors and bell accessories are also included.

A D.P. Cartridge Replacement Fuse

A sample of a new d.p. 2-A cartridge replacement fuse has been sent to us by MESSRS. WARD & GOLDSTONE, LTD., Frederick Road, Pendleton, Manchester, 6. It is designed specially for use on the secondary side of a bell transformer in accordance with I.E.E. Regulation No. 210.



The new "Goltone" 2-A fuse

Since the fuse is entirely separate from the transformer it can be fitted to existing transformers already installed, so that when a fuse requires replacing there is no need to interfere with the transformer itself—it is unnecessary, for instance, to remove the cover of the transformer and run any risk of touching the high-voltage terminals.

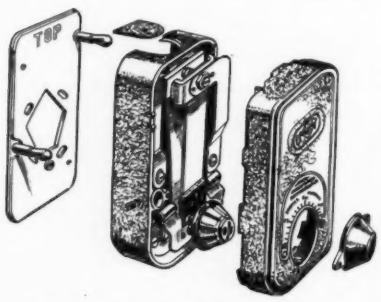
Space Heating Developments

EQUIPMENT which we recently had the opportunity of inspecting at the offices of UNITY HEATING, LTD., Vincent House Vincent Square, Westminster, S.W.1, includes a range of improved convectors with thermostatic control, an improved model of the "Sunglow" combined lighting and heating ceiling unit, a redesigned "Unity" thermostat and improved "Flood" heaters.

Improved "Sunglow" heating and lighting unit with two semi-circular tubular lamps

The outstanding feature of the convector models, which are available in 750-W, 1,000-W and 1,500-W sizes, is that the readily adjustable thermostat setting permits what is, in effect, infinitely variable control from 45 deg. F. to 75 deg. F. There is a suitably graded illuminated scale fitted in the front of the case and turning the control handle a little beyond the "low" end of the scale switches the elements off. The thermostat proper is of the spiral bimetal type and is placed at the bottom of the front of the case in such a way that it is operated by the actual air temperature of the room, being uninfluenced by the convector temperature. A shield at the back of the thermostat, that is, in the convector housing, not only protects the thermostat from radiation from the convector elements but also affords a duct for a current of air separate from the main current through the convector.

The elements are of the mica sandwich type sheathed in steel in wide strip formation; they are situated just below the grilles and run from side to side inside the casing, with the largest areas in the vertical plane. Spacing is such as to afford air currents on each heat emission face. The number of rows of elements varies with the size of the convector, the largest model having four rows. Blade-type elements have been adopted so as to permit a fairly high air speed with an air exit temperature varying from 160 deg. F. to 180 deg. F.

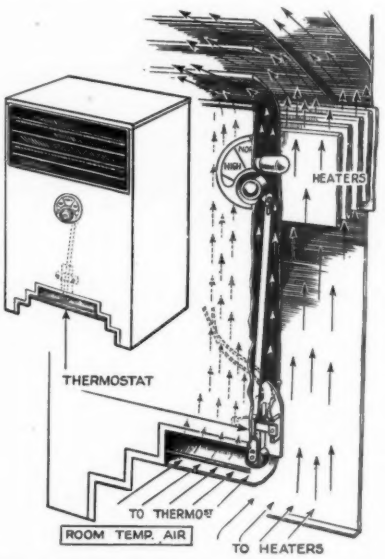


Details of the twin-blade bi-metal thermostat

Mr. R. C. Symondson, of Unity Heating, maintains that the loading is of secondary importance, the main requirement being to keep the temperature down to the limits required for comfort. The external dimensions common to all three sizes are 30 in. high, 20 in. wide, with a projection of 10 in., and the standard finishes are speckled green, blue and mahogany, and also plain bronze.

"Flood" heaters, in the same standard sizes and loadings as before, *i.e.*, 25 in. by 13 in. (1,250 W), 13 in. by 12 in. (600 W), and 25 in. by 5 in. (500 W) are now available as improved models in which the previous discoloration tendencies, due to the "high temperature" heating, have been overcome. More rigid fronts to the heaters and a special vitreous enamel with the same coefficient of expansion as the heater panel have contributed to this result.

The "Sunglow" combined heating and lighting unit now has two semi-circular tubular lamps arranged round the periphery of the bowl and immediately under the bowl-containing ring of the frame in which are located the sockets which receive the lamp plugs. The "inverted bowl" heater is loaded at 1½ kW and the two lamps are rated at 60 W each.



Construction of the "Unity" convector with variable and thermostatic control

We believe the new thermostat to be of original design by reason of its two contact bearing bimetal strips operating in opposition. This results in double the sensitivity of the single strip of the same length and a greater sensitivity than a strip twice the length because of the increased mechanical strain in the longer strip itself, while the more compact unit afforded by the shorter strips is an advantage. In parallel with the strips are very flexible conductors which carry the bulk of the current so as to eliminate internal heating which must necessarily effect the operation.

To discourage meddling with the inside the lid has intentionally been made difficult to remove. The thermostat proper has a bakelite case, but there is also a metal back plate which is easily released by slackening two grub screws in the sides of the case. This exposes the thermostat terminals at the back of the recesses and there is plenty of cable space; back entry is afforded through the back plate and top and bottom entry by the removal of fillets in the case. The instrument is adjustable from 50 deg. F. to 70 deg. F., a suitable scale being provided. An optional cover fits over the handle and conceals the scale from those people who are apt to regard the thermostat as an accelerator rather than as a governor. By means of a side to side insulated sliding rod with on and off indications, on the lines of a push-bar switch, the thermostat can be put out of action at night, thus eliminating the necessity for an overall control switch.

Running a Wholesale Business. By M. McKerlie

Saving time, labour and expense

IN a system or method for dealing with office work, and in this instance for dealing with a distributive function, two main principles must be kept foremost:—1. In all internal matters copying work should be reduced to the minimum. 2. All orders received should be executed with the least possible delay and expense. The first essential which is too often overlooked is rapid and efficient means of filing documents. To avoid re-copying, the original document must be used whenever possible, and if it is performing various functions it follows that it must be instantly available.

In a distributing business there are three main divisions:—1. Goods outwards; 2. Goods inwards; and 3. Accounting. Most distributors or wholesalers, and certainly in the electrical trade, handle standard lines, here called "stock," and non-standard lines, here called "specials." Specials are not held in stock for immediate delivery, but have to be obtained with more or less delay.

The company with which I am connected (Baxter & Caunter, Ltd.) employs a visible card system stock record with some new ideas. There is a card for each stock item showing description, catalogue number, maximum and minimum levels, and other non-variable information. Over this card are hung a blue sheet and a white one. The former is mainly a record of buying and selling prices. It is also an inventory record as annual stocktaking has been eliminated. The white one is for quantities only in three columns—"In," "Out," and "Balance."

The white sheet is entered from a goods received voucher for "In" and from outwards advice notes for "Out." After every entry a new "balance" is struck. Quantity in stock is instantly known and can be compared with the minimum level. Beside each stock card is a pocket card containing a re-ordering card showing the usual suppliers, prices, technical description of article, date of order, quantity, date wanted, authority for ordering and remarks.

When the balance reaches the minimum the re-ordering card is removed by the stock clerk and most of the information is filled in. It is passed to the buyer who authorises the purchase when satisfied that it is correct. The actual order can be made out by any of the order clerks and the card remains out of its pocket until the goods come in. The absence of the card indicates that an order has been placed. Both the stock card and the re-ordering card can be signalled for any desired purpose.

There are about two hundred goods inwards bins of different sizes, numbered for "special" goods until their delivery.

Despatching Arrangements

The van delivery planning board is a large wall board with rows of spikes on which packing notes are arranged to plan the work of despatch according to van routes by separating immediate from later deliveries. One row is marked "Not Ready" with a spike for "Next Van" and another for "Later Van." On these are placed all packing notes awaiting attention. Another row is marked "Ready" with a spike for "Next Van," and another for "Later Van." On these are placed all packing notes for which goods have been taken out of stock, the actual goods having been placed in squares marked out on the floor corresponding to the spikes. The goods and packing notes accumulate in their respective places until the next van is despatched. Notes are then transferred to a "Despatch Van" spike and await the return of the van for adjustments of refusals or returns to be recorded. They are then placed on a "Cleared" spike whence they are removed for office work.

The sales ledger is a visible card system to which monthly totals of sales, receipts and balances are posted. The visible edge of this card shows the month owing, in what month purchases have been made, the representative, the type of accounts letter sent, whether the credit is stopped or the account has been queried, whether there is a balance and one or two other special features. As roughly a hundred cards are visible at one time a comprehensive and invaluably rapid picture is shown without examination of individual cards. Subdivision by control cards gives sectional balancing.

Orders are received by post and telephone. They are passed for credit and go on to the stock clerk to be "edited" or marked in code to show what action is to be taken, i,e. (1) delivery from stock; (2) out of stock—to be ordered; (3) special—to be ordered. Deliveries from stock are entered in pencil, thus preserving the running balance. Orders are then passed on to an "Edited" basket and triplicate advice notes are made out for all items from stock

The copies are: (1) Packing notes and (2) advice note, which are together placed in the "Van" basket for frequent collection by the Despatch Department; and (3) accounts copy used for confirming pencil posting of the "Out" column on the stock record and passed on to the Invoicing Department for preparing the typed invoice.

The advice note is placed with the goods in the "Next" or "Later" van square and the packing note on the corresponding spike on the planning board. For "Out of stock" and "Special," orders-outwards have to be made. The procedure is nearly the same excepting that stock items are bulked for the same articles and are cleared when that stock item is received.

A great difficulty is to have the customer's original order instantly available for reference in case of question. To hold a variety of unexecuted and partly executed orders of all shapes in this readily accessible state is an impossible task. So the outstanding items are copied on to a standard form called an "extract." This copying is done by a junior and after checking with the original by a skilled person who can thus early raise queries, the original is filed in its final place where it becomes instantly available. This permits of flexible handling of the outstanding portions as they can be distributed amongst a number of people for action.

Purchased Goods

The processes here become merged into "Goods Inwards." The order outwards directs attention to one of the key forms. The carbon copy of this order is carefully designed to provide a copy of order with prices; a "hurrying" medium; a receipt note of goods inwards; the destination of goods; the location of goods in "Special" bins; the stock posting of goods inwards; a check on inwards invoice; a check on inwards statement; and detail of payments made. This copy is called a "Goods Received Voucher." It is filed in numerical order on a special arch file. It is used, until cleared, as the means of hurrying delivery inwards.

When the suppliers' advice note reaches the warehouse it is checked for quantity and quality, marked with the number of the bin and passed to the goods inwards clerk, who removes the goods received voucher, stamps the date received and marks the bin number. It is passed to the Order Department, which from the customer's name can locate the extract and proceed to make the triplicate advice note as described. The bin number is marked on the packing note, thus giving the Despatch Department immediate location of the goods. The goods received voucher is then passed to the stock clerk for posting to stock, who sends it on to the Invoice Department. In the case of stock items and serial number checking in the case of "Specials" the invoice clerk extends the quantity at prices shown and matches to the suppliers' invoice, thus making the goods received voucher an exact replica of the invoice on a standard size form which contains the history of the goods from the time they were first ordered.

The invoices are now put in alphabetical order and checked to the suppliers' statement. Differences or the absence of a goods received voucher prevent payment for any item not received or wrongly charged. Differences are shown on the suppliers' statement and cheques can be drawn against these total amounts. The goods received vouchers are bound in books in alphabetical-date order and thus provide as full details as a purchase or bought ledger, which cumbersome book is dispensed with.

Expenses as distinct from purchases are treated similarly. To obtain a corresponding document to the suppliers' statement, a payment voucher is made showing only the name of the supplier, the total amount, date paid and authority for paying. Payment vouchers are classified into different account numbers and their sorting and addition provides within an hour or two a monthly analysis of the expenses of the business to as fine detail as desired.

Sales Invoices

On the sales side, invoicing is picked up from the accounts copy of the advice note. Sales invoices are added daily to give total daily sales and a check figure for monthly statements. At the end of the month invoices are machine printed in triplicate, *i.e.*, statement to customer, debit voucher, and credit voucher. The debit vouchers are the media for posting the totals to the ledger cards for the main classes of goods. The credit vouchers are the media for clearing cheques and receipts and posting credits to ledger cards. Both debit and credit vouchers are bound in books alphabetically and provide the detail of the ledger cards.

The total control card gives monthly totals of sales in classes of goods, receipts, discounts, and debtors' balances. The time of clearing receipts is reduced to the minimum, as once the cheque has been identified with its credit voucher, at one operation it is entered on a bank paying-in slip in the cash

Electrical Refrigeration Prospects. By Ben Quarmby

Meeting organised gas competition

UNLESS a very vigorous sales policy is pursued by the electrical industry generally, embracing the supply authorities, wholesalers, and electrical contractors, the sale of domestic electrical refrigerators in the coming year is likely to suffer a serious decline, on account of the organised competition promoted by the gas industry. I do not expect the majority of those engaged in the electrical industry, or electrical traders generally, to be readers of the various gas journals. Those who are will have read of the remarkable success of a nine weeks' campaign in May and June of last year by a well-known south country gas combine, when during this period 7,500 domestic cabinets were sold for operation by gas, the sales for one particular day being over 400 cabinets.

Prior to this campaign—the first serious effort to sell refrigerators which the gas industry has ever made—there were few gas-operated cabinets compared with electric, and it is safe to say that the success of this campaign has awakened in the gas industry a desire for further expansion. A national council representing 98 per cent. of the gas-makers asks for their co-operation during 1936, and it is organised in such a manner as to amount to a centralised buying and supply agency, with a sufficiently fearless outlook to arrange to take the whole output of a firm, up to the present making both gas and electrically operated models, totalling 40,000 cabinets yearly, for a period of five years, a condition being the cessation of the manufacture of electrical models by this company.

Many of the smaller companies have promised their support to the scheme, undertaking to dispose of from 50 to 100 cabinets during the 1936 season. I find it difficult at this stage to try to imagine any electricity supply authority of my acquaintance considering seriously the possibility of being able to dispose of anything like this quantity of electrical refrigerators in one season, or of having the courage to think it possible, in spite of the fact that in many cases they have many more times the number of consumers.

Some review of the possibilities of electrical refrigeration, and of the methods to adopt to combat this competition will have to be made by the electrical industry generally if this valuable load is to be retained for the electricity supply authorities. Decisive and immediate action is necessary, and it must take the form of an extension of hire-purchase periods, without interest charges or large deposit, and the standardisation of a reputable make of refrigerator, with a good range of models and a long-term guarantee.

What Our Competitors are Doing

While the finer details of policy and procedure are left to each individual undertaking, it is generally assumed that as a rule a five-year guarantee will be given with each gas refrigerator, and that free fixing will be undertaken together with a five-year hire-purchase period, without interest charges or a large deposit. The gas undertakings in many instances are appointing full-time salesmen, with training in the subject provided by the British Commercial Gas Association, while the services of the gasfitters, who are in personal touch with "prospects" are to be utilised in canvassing. Something on these lines might be undertaken by the electrical industry, along with the special training of showroom assistants and engineers in refrigeration from a selling angle.

National advertising, special window displays and "cold cookery" demonstrations are to be an important feature of the gas programme, and it is strongly recommended that a full range of models should be purchased for showroom use and demonstration. An aggressive sales policy is recommended, first for the direct increase of the gas load, and secondly with the idea that the possession of an up-to-date refrigerator operated by gas will dispel the assumption in many quarters that gas is an obsolescent agent, and will lead to the further use of gas for cooking and other purposes in the home, and thus keep the electric cooker out of the house for many years.

The absence of any moving parts, complete freedom from wireless interference, and the assertion that gas-operated models are cheaper to operate, will all receive great publicity in the programme of the gas undertakings.

The advocates of electrical refrigeration have the ready sympathy of any prospect, when stressing the important feature of cleanliness, as the operation of a refrigerator with an open type gas burner necessitates the periodical cleaning of the chimney, and the removal of the accumulated soot, the electrically operated cabinet, of course, being perfectly clean at all times.

The question of operating costs is not quite so simply stated owing to the varying tariffs in different districts, but it may be assumed that cabinets operating on the various favourable all-in tariffs will compare advantageously, size for size, with the gas type, and if a make of cabinet is selected where the compressor is hermetically sealed, operated by a ⅛ h.p. electric motor, this claim of cheapness by the gas refrigerator can be thoroughly exploded. As this is likely to become an important factor in the sales programme it would be well to realise that it is the best possible policy for the electrical industry to adopt refrigerators that are economical in consumption, remembering that a large proportion of sales comes from the recommendations of the satisfied user.

Advantages of the Electrical Refrigerator

Supply authorities and electrical traders generally have a decided advantage with electrically operated refrigerators in that the range of models available is greater. Up to the present there have been only three air-cooled gas models—of 1, 2 and 4 cu. ft. capacity; larger models up to 10 cu. ft. capacity are available for operation by gas but these need a supply of runing water for cooling purposes and while it is thought that a 6 cu. ft. air-cooled pattern may be available for the 1936 season, serious competition may only be expected up to this size. The electrical range extends in some cases up to models of 25 cu. ft capacity; all are air cooled and incorporate a useful range of glass fronted showcases and display counters enabling the same sales force to market the whole range, thus securing a number of prospects for household models from satisfied users of semi-commercial units.

Plug points are often available in close proximity to the selected position for an electric refrigerator, and the question of installation is therefore much simpler than with the gas-operated cabinet which has on every occasion to be specially piped, very often from great distances. The regulation of temperature and quick-freezing is also a much simpler operation on the electrical models, as the control is usually fitted in an accessible position on the exterior of the cabinet, a feature as yet not possessed by the gas-operated model. The interior illumination of an electrically operated cabinet is a simple and reliable matter, while the lighting of the interior of a gas-operated model, at present supplied with a small electric lamp and worked by a battery, can be easily turned to advantage, or dismissed, by the electrical salesman.

The aim of the electrical industry should be all-the-year-round sales of electrical refrigerators, with the close co-operation of all parties in the industry, and substantially backed in a national manner by E.D.A. Window displays and "cold cookery" demonstrations must be arranged and encouraged, and general educational work be continued, together with the training of staffs, and the creating of a special department where necessary, with a competent person in charge solely responsible for refrigeration.

The Possibilities

It has recently been stated that only five British housewives out of every hundred possess refrigerators; twenty-eight out of every hundred have them in the United States. Experts have also recently stated that the next ten years will see the saturation of the domestic market in this country, giving some indication of the enormous immediate future possibilities in this desirable field which the gas industry is endeavouring to capture.

Refrigerator sales have increased considerably year by year, and I am of the opinion that the next five years will be the most crucial, and will see a greater number of sales than the last ten years, due to a great extent to the increased national advertising which will be a feature from now on. It is significant to note that the gas industry enters the field when the

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Running a Wholesale Business *(Continued from preceding page)*

book and on the customers' official receipt. This is possible by a special though simple design of paying-in slip.

Totals of all transactions are, for convenience, journalised into the ledger, this book being more or less a formality, since all its essential and useful information has been almost automatically produced in the course of the preparation work.

In a limited space it is not possible either to give a detailed comparison between the old and new methods or a full explanation of the new. But under the former methods the staff required greater experience and specialisation. There were more of them and this applied also to the books necessary. The work was mostly re-copying, and there was a lack of immediate information. Under the new system the staff is interchangeable and mobile, as processes are simplified. Special knowledge is not needed; there are fewer individuals and they are not so highly paid.

bulk of the advertising and educational work in refrigeration for the past ten years has been carried out by the manufacturers and sellers of electrical refrigerators.

Wherever electricity supply authorities have pushed the sale of electric refrigerators as part of their appliance-selling policy they have achieved satisfactory results and a gratifying increase in load. An extension of activity in this direction is amply justified, particularly as domestic refrigeration is now entering a vast and profitable replacement market, where we find a number of the original suppliers now out of business or no longer conspicuous factors in the industry.

The automatic domestic refrigerator rightly belongs to the electrical industry, and we must all combine, in the early stages, to meet any threatened opposition such as now arises; we must with one unanimous voice proclaim the undoubted advantages of the electric refrigerator, to prevent the installation of any other type, as when once installed the domestic cabinet usually becomes a permanent fixture for a long period.

Many chief engineers of electricity supply undertakings have refrained, up to now, from organising domestic refrigerator sales, on the grounds of excessive list prices, and in the belief that refrigerators would inevitably be much cheaper in the course of time. If this attitude persists how are we to expect manufacturers to lower prices, and give reasonable discounts and at the same time give longer guarantees and free service periods, together with up-to-date models.

Present-day refrigerators of any reliable make are good value. Prices around £40 for a cabinet of 4 cu. ft. capacity, and about £32 for a cabinet of 3 cu. ft. capacity, are reasonable and available to-day in the finest makes. On the grounds of continued satisfaction to the user only models with a porcelain exterior should be considered, and for preference those operated by the smaller motors, while to give satisfaction in freedom from service hermetically sealed units are to be preferred. The enclosure of the motor eliminates troublesome oiling problems, is much cleaner, and less likely to contribute to wireless interference. This type is calculated before long to completely eliminate the open type of compressor.

Other features to be looked for, and demanded, are longer periods of guarantee and free service, in view of the five-year period promised by the gas industry; this will become of considerable sales importance during the coming season. Guarantee periods of four years are available to-day with some makes of refrigerators, and may serve as an indication of the makers' confidence in their product.

Streamline cabinets, interior lighting, revolving shelves, handy door trays, large ice-making capacity, flexible ice trays, automatic defrosting, special control for cheaper running, ribbon shelving, button-touch door latches, dairy baskets, ribbed glass chilling trays, buffet cabinet tops, acid proof interiors, porcelain exteriors and several-point control, are all desirable sales features now obtainable in the latest model cabinets of reputable make.

There is every likelihood that well-known manufacturers who are at present giving long period guarantees, will extend their period to five years as some important measure of help to the electrical trade to meet the competition of the gas industry. This cannot be immediately expected from some of the smaller manufacturers who have hitherto been unable to exceed the usual 12 months' guarantee, unless list prices were increased.

It is a general opinion in the refrigeration industry, that the future will see a greater concerted sales push of the more reliable makes, and I feel that it would greatly assist if the manufacturers or main distributors, of any make would consider the giving of an additional retrospective discount on turnover, as an inducement to the supply authority, contractor, or appointed sub-distributor, to concentrate on the sale of one particular range. The electrical contractors should link up with the nearest area distributor for the make selected, and obtain assistance from the sales department, and the contractors' associations must be prepared to advise their members impartially on the respective merits of the different makes and to urge immediate action by their members.

In the Courts

MR. JUSTICE HORRIDGE, in the King's Bench Division on January 23rd, heard an action brought by Mr. R. C. Salt, Uxbridge, to recover damage against the Power Plant Co., Ltd., West Drayton, Middlesex, for alleged wrongful dismissal from his appointment of secretary and for arrears of salary which he alleged to be due to him.

It appeared that the plaintiff had originally been engaged as secretary of the defendant company at a salary of £400 a year, which had been increased from time to time to £600 a year. He alleged that his agreement of service was renewed by the defendants in December, 1925, on the terms that unless six months' notice was given expiring in December, 1929, terminating his engagement it became permanent subject to his performing his duties to the satisfaction of the directors of the company.

It was admitted by the defendants that the plaintiff had so performed his duties. Afterwards, during the trade slump in 1932-33, the plaintiff's salary was reduced to £450 a year. In June, 1934, the company gave the plaintiff six months' notice terminating his engagement, which the plaintiff alleged they had no power to do under the terms of his agreement, and he now sued for damages for wrongful dismissal and for arrears of salary from the beginning of the year 1934, when he said that the trade slump had ceased and when, as he alleged, his salary of £600 a year should have been reinstated.

The defence of the company was that upon the proper construction of the agreement and the letters which had passed between the parties and in the events that had happened the notice terminating the plaintiff's service was legally justifiable.

His Lordship so held and gave judgment for the company with costs which the company agreed not to enforce if the plaintiff did not appeal from the judgment.

A Lampworks Manager's Dismissal

Sheriff-Principal Black, Dumbarton, has issued his decision adhering to the judgment of the Sheriff-Substitute in the action by Mr. H. J. Osborn, Old Kilpatrick, against Aurora Lamps, Ltd., Old Kilpatrick. Plaintiff was awarded damages for alleged unjustifiable dismissal from his position as general manager of the company's lampworks (*vide* ELECTRICAL REVIEW, December 6th, p. 790).

The Sheriff-Principal added the following findings in fact to his decision:—On September 30th, 1933, the plaintiff gave the respondents notice of his intention to terminate his engagement with them; that the respondents declined to recognise that notice or to regard it as valid. He found the respondents liable to the plaintiff in the expenses of the appeal. In his note his Lordship said that without saying anything to the plaintiff of their intentions the respondents sought for a successor to him and finally engaged one. Having done so they summarily dismissed the plaintiff. The ground for their action was stated to be the desire to minimise the loss which they might suffer through the plaintiff's breach of his contract with them. In his Lordship's opinion the respondents' action was not warranted. The respondents maintained alternatively that they were justified in dismissing the plaintiff, on the ground that the plaintiff attempted to seduce the respondents' servants from their employment. This was given up, and the other reasons appeared to be exaggerated and fanciful.

A sinister complexion was sought to be given to the fact that a Mr. Downie visited the factory on a Sunday, but that was completely disproved by Mr. Downie's explanation of his inability to go on any other day. The idea that a man so completely unskilled as Mr. Downie could grasp in the course of a brief visit and take away, to the prejudice of the respondents, the secrets of a highly technical process appeared to border upon the absurd. The two remaining incidents were equally without substance. The decision to carry out an urgent repair on machinery rather than to attend a meeting with travellers was just such a matter as must be left to the discretion of a manager.

His Lordship came to the conclusion that the respondents having elected to disregard the notice given by the plaintiff were not entitled to found upon that notice as the ground of their dismissal of him on December 4th, 1933, and further that they failed to prove the other grounds which they found on as justifying their action and that, accordingly, the plaintiff was entitled to decree for the sum awarded by the Sheriff-Substitute.

Radio Royalties Action Settled

In the Chancery Division on January 24th before Mr. Justice Eve a settlement was announced of the action brought by Marconi's Wireless Telegraph Co., Ltd., the Gramophone Co., Ltd., and Standard Telephones and Cables, Ltd., against E. K. Cole, Ltd., for an account of all sums alleged to be due to the plaintiffs in respect of royalties under an agreement dated April 10th, 1930.

When the case was called on Mr. Cyril Radcliffe, K.C., for the plaintiffs, told his Lordship that he would not be troubled to try the case as the parties had come to terms. He said that the plaintiffs were the owners of a group of patents relating to wireless broadcasting and the action concerned a licensing agreement granted to the defendants. The terms of this were very complicated with reference to provisions for rebates on a sliding scale according to production, and the action was for an account of moneys alleged to be due.

The defence, as pleaded, raised not only in fact that the plaintiffs since the date of their licences granted more favourable terms to other manufacturers, but defendants also unfortunately made an allegation of misrepresentation against the plaintiffs which allegation was, of course, strenuously denied. One of the conditions of the terms agreed was that this allegation of alleged misrepresentation was now withdrawn. Each party would pay its own costs.

Mr. J. G. Strangman, for the defendants, concurred with Mr. Radcliffe's statement.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

The British Industries Fair

It is officially announced by the Department of Overseas Trade that the British Industries Fair, organised by the Department at Olympia and the White City and by the Birmingham Chamber of Commerce at Castle Bromwich, will be held in accordance with previous arrangements. The Fair will open on February 17th, and will continue until February 28th.

The Department announces the cancellation, out of respect for the memory of His late Majesty King George V, of the banquet which was to have been given by the Government at the Mansion House on February 17th to mark the opening of the Fair.

Electricity Supply Workers' Wages

The Industrial Court has decided that the award made last year for an increase of ½d. an hour in the rates of wages in the electricity supply industry is a general increase to all employés, irrespective of whether their rates of wages at the date when the award became operative were in excess of the rates provided for in the agreements or not.

The Empire Exhibition, South Africa

The organisers of the Empire Exhibition which is to be held at Johannesburg from September, 1936, to January, 1937, inform us that already over 80 per cent. of the total space originally laid out has been sold, and Lord Riverdale, chairman of the London Committee of the Exhibition, states that it is already clear that large extensions of the buildings will have to be carried out, particularly to accommodate the heavy engineering section. Special arrangements have been made with the South African Government by which exhibits and exhibition material can go into the exhibition free of duty, and the steamship companies and the South African Railways have agreed to bring back any exhibits unsold free of charge. There will also be specially reduced passenger fares both on the railways and the steamships. Further information relating to the exhibition is obtainable from the offices of the London Committee at 21, Tothill Street, S.W.1.

Denmark's Electrical Trade in 1935

Imports of electrical goods into Denmark in 1935 decreased by about 16 per cent. as compared with 1934, while exports rose by 50 per cent. Total imports during 1935 were 2,411 tons, or 477 less than in 1934, and exports aggregated 2,210 tons, an increase of 708 tons. Details of imports, with increases or decreases in metric ton units indicated in parentheses, are as follows:—Accumulator plates, 411 (+120); cables, 59 (+5); insulated wire, 460 (−230); generators and motors, 507 (−181); installation materials, 302 (−1); electrical equipment for motor cars, 51 (−3); dry cells and accumulators, 158 (−161); wireless receivers and components, 141 (−49); other electrical appliances, 322 (+43). The restrictive policy of the Government with regard to the import trade has offered the home industry a chance it has not hesitated to take, and a large expansion of the industry has occurred during the past year. Increased employment in the electrical industry has led to more remunerative production, so that to-day many firms find it possible to produce goods at prices that enable Denmark to compete in the international market. Exports for 1935 demonstrate the growth of this industry, for while exports in 1934 were less than half the imports, in 1935 they nearly equalled imports in quantity. Details of exports are as follows:—Generators and motors, 903 (+285); refrigerating plants, 1,015 (+367); and installation materials, 202 (+56).

E.D.A. Public Speaking Competitions

Under the auspices of the British Electrical Development Association, competitions in public speaking were held in Leeds last week. Twenty-two candidates, all under thirty years of age, from the electricity undertakings of Yorkshire and Lincolnshire, were given auditions at the electricity works, Whitehall Road, Leeds. In the women's section, the first prize (£5 and certificate) was awarded to Miss Muriel Arguile (Halifax Electricity Department), and the second prize (£3 and certificate) to Miss Marjorie Bolton (South East Yorkshire Light & Power Co.), both choosing as their subject "How Electricity Helps the Farmer." In the men's section, the winner of the first prize (£5 and certificate) was Mr. L. W. Milnes (Leeds Electricity Department), who spoke on "The Influence of Electricity on Health," the second prize (£3 and certificate) being awarded to Mr. B. H. Prest (Bradford Electricity Department), whose subject was "Advantages of the All-in Rate." The judges were Ald. J. W. Schofield (Batley), Mr. A. C. Bostel (Sheffield), and Mr. G. S. Francis (London).

A "Garden" Restaurant

An artificial magnolia tree with illuminated flowers makes an appropriate centrepiece for the "old world garden" restaurant just completed at 142, Park Lane, London, W.1. Imitation stonework walls apparently covered with growing flowers, a grape vine concealing tubular lamps over the windows, and a crescent moon suspended from the centre of the ceiling all assist in creating a realistic atmosphere, which is made even more effective by an imitation log fire. On the buffet counter is a 200-W "Magnet" hot-plate to keep warm the food sent up from the kitchens. The kitchens themselves though not new are all-electric, the main one containing two large double ranges, while the service kitchen possesses a cooker, grills, hot-plates and a water heater all manufactured by the Jackson Electric Stove Co., Ltd. In addition to the restaurant, forty-two flats are also served by the kitchens. The lighting installation in the new restaurant was carried out by Messrs. Harvey Nichols & Co., Ltd., Messrs. J. H. Andrews, 19, Berkeley Street, W.1, being the electrical contractors for the kitchen equipment and also for the neon signs (Claude-General) outside the building.

The restaurant and main kitchen at 142, Park Lane, W.

Runwell Mental Hospital

The Runwell Mental Hospital, near Wickford, Essex, is being erected jointly by the Corporations of Southend and East Ham to accommodate approximately 1,000 patients. The electrical scheme includes a theatre, complete with cinema projector and talkie apparatus. Henley cables are being used exclusively for all the exterior and interior circuits, and the buildings themselves are being wired with Henley "Superite"

cables. Power is generated by the steam and oil engine generators of the Institution's self-contained plant, and the supply to the various buildings is carried by Henley p.i. lead-covered and steel-tape armoured and served cable laid in open trenches around the grounds and in ducts where the cables enter the buildings. The mains cables (0.3 sq. in., 3-core for power and 0.12 sq. in., 3-core for lighting) form a ring main running east and west from the power station *via* two Henley overground disconnecting boxes. From the overground disconnecting box on the east side three power and three lighting feeders serve the chapel and the admission and women's convalescent unit, women's infirm and epileptic units. A further feeder from this overground disconnecting box, looping in and out of the men's convalescent unit and the nurses' home, terminates at another overground disconnecting box on the southern border of the site. This box feeds the senior physician's and superintendent's residences and the staff houses. From another overground disconnecting box on the west side two power and two lighting feeders serve the closed unit, men's infirm and epileptic units. The main administration building, the recreation room (which contains the theatre), the kitchen and the laundry are each served by a direct cable-run from the power house, the cables in this instance being drawn into ducts. The men's and women's parole units are also connected to the power house direct by cables laid in open trenches. A fire alarm and time clock system, together with wireless and telephone services, are looped from building to building in a similar fashion to the power cable circuit. It is interesting to note that each cable is a continuous length looped from switch-room to switch-room for all the important buildings. The total length of p.i. lead-covered and steel-tape armoured cable used was 27,600 yd. The main building contractors are Messrs. John Mowlem & Co., Ltd., and the electrical contractors Messrs. Bell Bros. & Co. (London), Ltd., to whom Messrs. W. T. Henley's Telegraph Works Co., Ltd., are sub-contractors for the cable work. The consulting engineer for the whole of the electrical scheme is Mr. Edgar W. Dorey, and the architects are Messrs. Elcock & Sutcliffe.

Lighting of a Dublin Cinema

The new St. Stephen's Green Cinema, Dublin, is of modern design and the lighting installation is of particular interest.

The auditorium of the St. Stephen's Green Cinema, Dublin

This is by the Holophane auto-selective system of colour lighting. The main auditorium ceiling lighting is by means of the moulded contour system. The ceiling is divided into four arched bays formed by three inverted coves, each of which supports over 40 ft. of Holophane three-colour prismatic reflector units. All the wall and ceiling surfaces are specially treated with white, silver and warm pastel colours. The stage lighting of draperies was designed by Holophane to produce colour-lighting displays, and the stage equipment consists of two battens, a footlight and three-colour wing floods on trolleys. A No. 1 batten consists of two battens bracketed together at an angle of 60 deg. to provide special lighting over the acting area. The scheme was designed by the Stage Lighting Department of Holophane, Ltd., in conjunction with Mr. E. O'Reilly, A.M.I.E.E., consulting engineer, Dublin. The electrical installation was carried out by Mr. A. G. Bruty, Dublin.

An Engineer's Guide

The 1936-37 edition of "*The Engineer* Directory and Buyers' Guide" is similar to previous editions, and includes an index and technical vocabulary in French, German, Italian and Spanish, a directory and buyers' guide, an alphabetical list of manufacturers, with telephone numbers and telegraphic addresses, telegraphic addresses and codes used, and a list of British Standard Specifications and reports.

Social Event

The Lancashire Dynamo & Crypto's party for its employés' children, which is held annually under the auspices of the Social Club, was once more the occasion of nearly 200 children spending a happy Saturday afternoon and evening on January 11th. After tea there was a children's pantomime, which was given by several members of the company. The rest of the evening was spent in various amusements, and the party terminated with the distribution of prizes, sweets, fruit, etc., by Santa Claus (Mr. H. P. Pentelow). Those present included Mrs. and Mr. J. H. Dunbar (director and president of the Social Club), Mrs. and Mr. W. A. Scott (works manager and vice-president of the Club), Mr. A. W. Smith (chairman of the Club), and Mr. J. T. Whalley (secretary).

Plant Depreciation

A useful little book on "Depreciation Allowances" has been received from Messrs. Leopold Farmer & Sons, 46, Gresham Street, E.C.2. It is designed to enable manufacturers and accountants to arrive at suitable figures for book-keeping, costing and income-tax purposes where there is no agreed rate between manufacturers and the income-tax authorities. The book contains 52 pages of tables, each page relating to a particular industry or trade. Suitable percentages are given for the types of plant and equipment used, and where rates of depreciation have been agreed with the income-tax authorities these are stated.

A School of Wireless Communication

The Marconi School of Wireless Communication, which has been established since 1901, and for the last fifteen years has occupied premises known as Chelmsford College at Arbour Lane, Chelmsford, is, owing to the increased demand on its services, to be transferred in the near future to a new and larger building to be erected in the same grounds at Arbour Lane. It will be equipped with the latest apparatus to meet all the requirements for practical instruction in modern wireless technique in every branch of its manifold development. The residential accommodation is also being extended.

An Advertising Novelty

The Edison Swan Electric Co., Ltd., has issued a novelty in the form of a "magic square" puzzle. This consists of eight pieces of cardboard cut in varying sizes which, when placed together in proper order, make a square. We have also received from the company a stylish propelling pencil.

Brass Wire Products

The latest booklet (No. 16) issued by the Copper Development Association deals with brass and other copper wire and wire products. It is produced in the same form as the previous booklets in the series.

Difficult Transport

Unusual difficulties are experienced in transporting to site the electrical equipment needed by the Frontino Gold Mines in Colombia, South America, where an additional power station is to be constructed. These mines are situated near the small town of Remedios at an altitude of about 2,500 ft. and are cut off from roads, railways, and other means of transport by precipitous and, in places, swampy country. Plant is shipped to Puerto Colombia, on the Caribbean Sea, carried by rail to Barranquilla about twenty miles away, and from there starts a journey of 350 miles up the river Magdelena and its tributaries. These waterways are very shallow in places and paddle boats of small draft are employed. It is not until the company's store at Zaragossa is reached, however, that the real difficulties of the journey begin. From this point to the mines is a distance of forty miles over a rough narrow track, and the only possible means of transport are mules. All plant must be designed and constructed, wherever possible, in such a way that it can be made up into 150 lb. packages to be re-assembled on the site. In most cases, this means that the windings of motors, &c., must be removed and despatched separately, the machines being re-wound when they are received at the mines. Among the plant at present being manufactured for the Frontino mines is a Crompton "KLAD" switchboard, which will be packed in 150 separate cases, and twelve 167-kVA, B.E.T., single-phase transformers to be coupled in three-phase banks.

An effective counter cut-out displaying "Royal Ediswan" lamp cartons and price lists which is now being distributed

The transformer tanks weigh 450 lb. each and will be slung between four mules on the last stage of the journey. The generating plant, which is at present under construction, is for use on the tail race of one of the two existing power stations. The power plants are situated some miles from the mines and the generating voltage of 550 is transformed up to 11,000 V for transmission by overhead lines. The mines themselves are scattered and are entered by inclined or vertical shafts, the deepest being 2,500 ft. on the incline. Messrs. Heap & Ryley, Ltd., are the electrical consulting engineers to the Frontino Gold Mines, Ltd., and the plant is designed to their specifications.

Fires

Mr. E. W. Hill, the general sales manager of Aron Electricity Meter, Ltd., informs us that an outbreak of fire occurred at the company's Salusbury Road works, Kilburn, on January 29th. It was quickly subdued by the Willesden Fire Brigade and was confined to a test room and a machine shop. Apart from a small temporary dislocation it is not expected that the company's output will be affected.

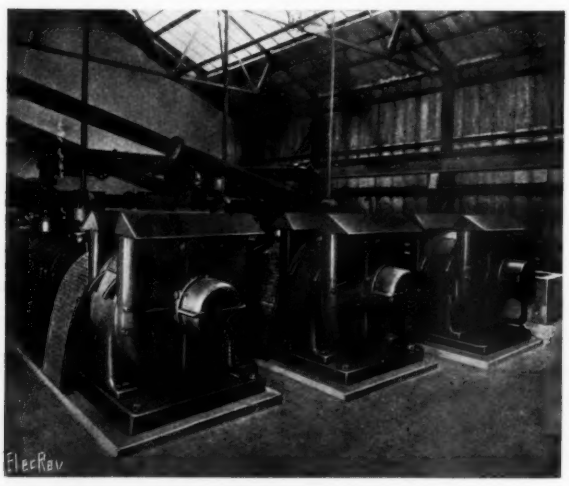
The *Manchester Guardian* reports that serious damage was caused by fire at the Barnsley works of Ceag, Ltd., on Tuesday last. After the fire Mr. R. J. Plummer, the managing director, stated that reconstruction of the works would be commenced immediately and that temporary premises would be acquired in which to carry on the business of the affected parts.

Price Increase

Messrs. Dorman & Smith, Ltd., inform us that, owing to recent increases in the cost of both labour and raw material, they have been compelled to advance all their price lists by 5 per cent., as from February 1st.

Electricity in a Cardboard Box Factory

Many important sections of the new plant at the cardboard box factory of Messrs. Hugh Stevenson & Sons, Ltd., Summerstown, S.W.17, are completely electrified, and the main board machine, which is steam driven, is provided with electric motors for the auxiliary drives. L.p. switchgear, distribution boards, &c., and motors aggregating some 700 h.p., were supplied by the General Electric Co., Ltd. The electricity supply for the new extensions is taken from the 11,000-V, three-phase, 50-cycle mains of the County of London Electricity Supply Co., Ltd. Power is stepped down to 400 V in the works substation; from which two l.p. feeders lead to G.E.C. distribution switchboards in the main board mill and also in the box factory. The main supply for the latter is taken at 220 V, single-phase, 50 cycles from the Wimbledon Corporation. The switchboard for the board mill is installed in the beater house and consists of five panels. The box factory is equipped with a four-panel, industrial type switchboard, one unit controlling the incoming supply while the others control power and lighting feeders to the factory and boiler house. In the beater house the main motor drives consist of beaters and refiners; the beaters are driven through short-centre vee ropes and the refiners direct coupled through flexible couplings to six 100-



Three 100-h.p. "Witton" slip-ring motors at Messrs. Hugh Stevenson & Sons' cardboard box factory

h.p., 360-r.p.m. "Witton" slip-ring motors with oil-immersed, hand-operated rotor starters. The auxiliary equipment of the new board machine includes two centrifugal water pumps, vacuum pumps, forced and induced draught fans, &c., all of which are electrically driven. The largest pump is capable of delivering 792 gal. per minute against a head of 120 ft.; it is directly driven through a flexible coupling by a 42-h.p., 1,460-r.p.m. "Witton" slip-ring motor. The second centrifugal pump is installed in a pit at the wet end of the machine, whence it takes "back water" to the beater house for further use in the beaters and in the machine and refiner head-boxes. This pump has an output of 500 gal. per min. at a head of 60 ft., and is driven by an 18-h.p., 1,450-r.p.m. "Witton" squirrel-cage motor. The vacuum pump, which is of the Jennings "return line" type, is installed on the dryers of the board machine, and it is driven by a 3-h.p., 1,425-r.p.m. "Witton" squirrel-cage motor. Two further vacuum pumps are installed in connection with the Sturtevant heating equipment (in the paper store, &c.) and the box factory plant, the outputs being 13,000 and 7,600 lb. per hr., and the motors 5 h.p. and 3 h.p. respectively. "Witton" motors are also employed on container machines in the box factory, one being belt-driven by a 20-h.p., three-phase, variable-speed, slip-ring motor, and two by single-phase motors of 20 and 30 h.p. respectively, through Croft's variable-speed gears.

Electric Vehicles in the Rossendale Valley

The accompanying illustration, reproduced from a photograph sent to us by Mr. J. E. Shepherd, borough electrical engineer, Rawtenstall, shows the first electric vehicles to

Electric vehicles at Rawtenstall

operate in the Rossendale Valley. It will be seen that the opportunity has been taken to advertise the Rawtenstall Electricity Department.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances :—

CHEMICALS, ETC.	Price, January 29th.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£36	—
a Ammonia, Muriate (large crystal) ... „	£18 10s.	—
a Borax ... ... „	£17	—
a Copper, Sulphate ... ... „	£15 10s.	—
a Potash, Chlorate ... ... per lb.	3¾d. to 4¾d.	—
a „ Perchlorate ... ... „	6d.	—
a Shellac ... ... per cwt.	£4 18s.	—
a Sulphur Commercial ... ... per ton	£11	—
a „ Roll ... ... „	£11	—
a Soda Chlorate ... ... per lb.	3¼d. to 3¾d.	—
a „ Crystals ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. nett.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b „ Wire ... ... per lb.	1/1 to 1/9	—
b „ Sheet and Foil ... ... „	1/3 to 2/9	—
p Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£195	—
Grade II ... ... „	£135	—
Grade III ... ... „	£71	—
c Brass (rolled metal 2" to 12" basis)... per lb.	7¼d.	—
c „ Tubes (solid drawn) ... ... „	9¾d. to 10d.	—
c „ Wire, basis ... ... „	7¾d.	—
c Copper Tubes (solid-drawn) ... „	10¼d.	—
g „ Bars (best selected) .. per ton	£66	—
g „ Sheet ... ... „		
g „ Rod ... ... „		
d „ (Electrolytic) Bars ... ... „	£39 10s.	10s. inc.
d „ „ Wire Rods ... „	£45 10s.	10s. inc.
d „ „ H.C. Wire ... per lb.	7 1/16d.	1/16d. inc.
f Ebonite Rod ... ... „	1/6 to 2/– plus	—
f „ Sheet ... ... „	1/3 to 1/6 10%	—
n German Silver Wire ... ... „	2/5	—
h Gutta-percha, fine ... ... „	nom.	—
h India-rubber, Para-fine ... ... „	7¼d.	¼d. inc.
i Iron, Pig (Cleveland No. 3) ... per ton	67/6	—
i „ Wire galv. No. 1, P.O. Qual.... „	£20	—
g Lead, English Pig ... ... „	£18	£1 inc.
g Mercury ... ... per bot.	£12/7/6 to £12/18/6	—
e Mica (in original cases) small ... per lb.	6d. to 1/–	—
e „ „ medium ... „	5/– to 10/–	—
e „ „ large ... „	10/6 to 17/6 up	—
p Phosphor Bronze, plain castings ... „	1/1	—
p „ „ drawn bars & rods „	11¼d.	—
p „ „ rolled strip & sheet „	11d.	—
p „ „ wire ... ... „	1/0½	—
o Platinum ... ... per oz.	£7	17s. 6d. dec.
d Silicium Bronze Wire ... ... per lb.	8½d.	1/16d. inc.
g Spelter ... ... per ton	£15 1s. 3d.	13s. 9d. inc.
r Steel, Magnet, in bars ... ... per lb.	7¼d.	—
g Tin, Block (English) ... ... per ton	£201	£12 5s. dec.
n „ Wire, Nos. 1 to 16 ... ... per lb.	3/8	—

Quotations supplied by :—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. F. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in our "Business Notes" under the same heading.

Trade Announcements

Messrs. Aish & Co., of Kelverton Road, Bournemouth, ask for manufacturers' latest lists of contractors' materials.

The J.P. Tubular Heater Co., Ltd., has removed its London business to Evelyn House, 62, Oxford Street, W.1, under the continued management of Mr. C. Whitaker.

The British (Guest Keen Baldwins) Iron & Steel Co., Ltd., has changed its name to Guest Keen Baldwins Iron & Steel Co., Ltd.

Messrs. Constable, Hart & Co., Ltd., have recently appointed the Surrey Distributing Co., Ltd., 43, High Street, Sutton, as sole distributors for the South of England, including London and the Home Counties, of their "Parlee" automatic door opener.

The Newcastle branch offices of Siemens Electric Lamps and Supplies, Ltd., have been removed to Siemens House, Carliol Square, Newcastle-on-Tyne. The telephone number and telegraphic address remain unchanged.

Criterion Display & Decoration, Ltd., of Falmouth Road, Elephant and Castle, London, S.E.1, has recently extended its business to include mechanically and electrically operated window and exhibition displays, architectural lighting design and installation, &c., and has appointed Mr. W. S. Potter-Hanwell (until recently chief electrical engineer to the Egyptian Government Irrigation Department in the Sudan) to take charge of this department.

Norwegian Electrical Imports

The statistics regarding Norway's imports of electrical goods during 1935 confirm the general impression of prosperity. The aggregate value of imports rose from £1,015,100 in 1934 to £1,244,180 last year, an increase of 22 per cent. The advance is general except for radio receivers. The greatest increase is in imports of generators, cables and insulated wire; in the case of generators the value was doubled, while imports of cables and wire rose to 2,020 tons as against 1,325 tons in 1934. An analysis reveals the following figures:—Electric motors, £115,964; generators, £29,876; transformers, £22,667; heavy switchgear, £37,625; household switches, £22,585; wireless receivers, £153,040; wireless components, accessories and valves, £59,957; lamp sockets, 178 tons (metric); cooking appliances and irons, 63.3 tons; telephone and telegraph apparatus, 126 tons; incandescent lamps, 129.3 tons; accumulators and storage batteries, 522 tons; dry cells, 374 tons; and cables and insulated wire, 2,020 tons. Exports were practically confined to cables, and the total fell from 365 tons in 1934 to 185 tons last year.

For Sale

Manchester Corporation invites tenders for the purchase and removal of rotary and motor convertors and transformers.

Sheffield Corporation Electricity Department has for sale alternators, condensers, water-tube boilers and transformers.

(See our classified advertisements.)

Engineers' Year Books

The 1936 edition of the "*Mechanical World* Electrical Year Book" (Emmott & Co., 1s. 6d.) has now been published. In this new edition tables relating to cables and conduit capacity have been revised to conform with the latest I.E.E. Regulations and explanatory matter on electricity tariffs has been added. Other new information concerns protective systems for generators, voltage regulation in the section on transmission and distribution, and some revisionary matter in the section on lighting. The tables on electrified railways have been revised and extensions opened during the year included. The "*Mechanical World* Year Book" has also been issued at 1s. 6d., containing up-to-date information on steam and power plant, internal-combustion engines, materials, &c.

New Catalogues and Lists

Corporation of Electric Transport, Ltd., 77, High Street, Marylebone, London, W.1.—A catalogue of Morrison electric vehicles, for which the company is South of England distributors.

Rawlplug Co., Ltd., Cromwell Road, London, S.W.7.—A list of new "Master" tools, including an adjustable spanner, a fixed ratchet spanner, and a pipe wrench.

W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, London, E.C.1.—A new catalogue of jointing accessories; the company's range now includes self-vulcanising tape, "Holborn" tape and plastic compound.

British Insulated Cables, Ltd., Prescot.—Leaflets dealing with varnished, cambric-insulated cables, and plumber's metal and soldering fluxes.

Ateliers de Construction Electrique de Charleroi, 56, Victoria Street, London, S.W.1.—A January stock list.

Heatrae, Ltd., Norwich.—A catalogue of the latest range of electric fires.

John Bee, Sunny Bank, Hambleton, Blackpool.—A leaflet on the "Cosy" brooder.

Felco Hoists, Ltd., 17, Victoria Street, Westminster, London, S.W.1.—An illustrated leaflet dealing with "Felco" all-steel, triple-gear chain blocks.

Gent & Co., Ltd., Faraday Works, Leicester.—A new edition of the No. 2E telephone catalogue.

Ferranti, Ltd., Moston, Manchester, 10.—Literature is now available regarding the new all-wave receivers.

Petters, Ltd., Yeovil.—A catalogue of electric lighting and power generating sets.

Hunton, Ltd., 114-116, Euston Road, London, N.W.1.—A list of triple universal bending, folding and rounding machines.

Constable, Hart & Co., Ltd., Broadway Buildings, London, S.W.1.—Leaflets describing Yale-type and bumper-operated electrically controlled door locks.

Bankruptcy Proceedings

W. E. James, 8, Church Street, Ebbw Vale, Monmouthshire, radio engineer and merchant.—At this debtor's public examination at Tredegar on January 23rd, it was stated that the deficiency was £459. Debtor commenced the business during a period of unemployment, and for the first two years was successful, but subsequently the closing down of the local steelworks affected his trade, and he got into financial difficulties. He secured an agency from a Cardiff wholesale firm for the sale of radio sets on hire-purchase terms, and the greater part of his business was done on that basis. He had incurred a number of bad debts owing to defaults. The examination was adjourned.

W. H. Colman, 37, Rowlands Road, South Yardley, Birmingham, Warwickshire, lately carrying on business as "Colman & Co.," Dale End, Birmingham, electrical and radio engineer.—The first meeting of creditors took place at the Official Receiver's Office, 159, Gt. Charles Street, Birmingham, on January 23rd. The statement of affairs showed ranking liabilities of £1,182, and net assets of £302, leaving a deficiency of £880. Debtor said that his failure was due to ill-health, inability to collect book debts, and drawing in excess of profits.

K. F. Butcher, radio dealer, Hook Lane, Welling, formerly trading at Eltham as the "Radioelectric Co."—An application was made on January 22nd at the London Bankruptcy Court for an order of discharge on behalf of this debtor, who failed last August with liabilities of £186 and assets of £16. The debtor attributed his insolvency to heavy overhead expenses, competition and other causes. The discharge was suspended for six months.

W. A. Prince and **C. S. Prince** (Prince Brothers), electrical contractors, 69, Princess Street, Manchester.—Receiving order made January 16th on debtors' own petition. First meeting January 31st at the Official Receiver's offices, Byrom Street, Manchester. Public examination February 21st at the Court House, Manchester.

D. Gunningham and **A. E. Beacock** (Home Electrical Maintenance Co.), 39-40, Trevelyan Chambers, Boar Lane, Leeds.—Receiving order made January 15th on debtors' own petition. Public examination February 11th at the County Court House, Leeds.

S. G. Penrith, electrical contractor, 50, Mount Pleasant, Barrow-in-Furness.—First and final dividend of 7½d. in the £, payable January 29th at the Official Receiver's Office, 16, Cornwallis Street, Barrow-in-Furness.

L. Holzman, manufacturer of wireless electrical equipment, 1, Robert Street, Hampstead Road, London.—Application for discharge to be heard on February 13th at Bankruptcy Buildings, Carey Street, W.C.

R. J. Heath (Whitchurch Radio Service), 3, Brownlow Street, Whitchurch.—Last day for receiving proofs for dividend February 4th. Trustee, Mr. F. E. Bendall, Midland Chambers, Warwick Passage, Corporation Street, Birmingham.

C. G. Chilton, electrical engineer, 80, Parkwood Road, Boscombe, Bournemouth.—Receiving order made January 21st on debtor's own petition.

A. Harper, electrical contractor, 55, Albion Avenue, Beckfield Lane, Acomb, Yorks.—Public examination February 13th at the Law Courts, York.

Company Liquidations

Whitaker Electric Co., Ltd., 24, Percy Street, Tottenham Court Road, London, W.C.—The statutory meeting of creditors in this matter was held on January 22nd at Winchester House, Old Broad Street, E.C., when a statement of affairs was submitted showing liabilities of £2,612, all due to the trade. There was a fully secured creditor for £154, holding security valued at £170. The net assets were £1,520, leaving a deficiency of £1,092. The company was incorporated in March, 1934, with a capital of £1,000 paid in cash. For the first year's trading to March, 1935, the turnover was £7,936; there was a gross profit of £1,233 and a net loss of £700. A balance sheet was prepared for the period up to October 31st, 1935, showing sales of £5,748, a gross profit of £1,158, and a net loss of £163. A debenture was created in January, 1935, for £400, and it was agreed to repay that amount by quarterly instalments of £75. The payments became in arrear and at the beginning of January this year the debenture holder appointed Mr. R. Rule as receiver. Mr. Rule had been nominated liquidator by the shareholders of the company, and the creditors passed a resolution confirming his appointment. A committee of inspection was also nominated.

Henricks, Ltd., electrical engineers, 41, Church Road, Gatley.—The statutory meeting of creditors of the above was held on January 22nd at the offices of Messrs. Harry L. Price & Co., 47, Mosley Street, Manchester. A statement of affairs was submitted which showed ranking liabilities of £466, of which £464 was due to the trade, and £2 to a cash creditor. After allowing for preferential claims the net assets were £80 with a deficiency, so far as the creditors were concerned, of £386. The issued capital was £500, and as regarded the shareholders there was a deficiency of £886. It was reported that the company was incorporated in May, 1935, with a nominal capital of £500, and took over an existing business. Since the incorporation there had been a net loss sustained of £692 and the deficiency was attributed to that loss, together with the depreciation written off the assets, £123, and hire-purchase payments of £71. The creditors decided to confirm the voluntary liquidation of the company with Mr. A. T. Eaves, of Messrs. Harry L. Price & Co. as liquidator. A committee was also appointed.

Radio-Gram & Television, Ltd.—Winding up voluntarily for reconstruction purposes. Liquidator, Mr. B. T. Jansen, 170, Bishopsgate, London, E.C.2. (A new company with the same title, the registration of which appears on page 182, has been formed to take over the assets of the old company.)

General Cable Manufacturing Co., Ltd.—Meeting February 27th at 37, Walbrook, London, E.C., to receive an account of the winding-up by the liquidator, Mr. A. J. Foster. (A company with the same name was formed in November, 1934, to take over the business of this company.)

Edward Prior Electric Co., Ltd.—Meeting February 27th at Salisbury House, E.C.2, to receive an account of the winding-up by the liquidator, Mr. G. C. Stowell.

Electricity Supply

Lighting, Domestic, Power

Bedford.—PROGRESS OF RURAL DEMONSTRATION SCHEME.—At a recent Council meeting it was reported that, in connection with the rural demonstration scheme, there were 220 farms, 14 factories, 80 shops, hotels, &c., and 4,470 domestic premises connected to the mains at December 31st last, representing an increase of 115 connections during the quarter.

Clitheroe.—LOAN FOR DEVELOPMENT.—The Town Council is applying for sanction to borrow £19,930 for electrical development, including £5,216 for transformers, switchgear and underground mains in connection with the establishment of a new cement works in the borough.

Coventry.—LOANS.—The Electricity Committee is recommending application for sanction to loans amounting to £100,000 for mains extensions and sub-station equipment.

Croydon.—PROGRESS OF THE UNDERTAKING.—Mr. F. N. Rendell-Baker, the chief engineer and general manager of the Electricity Department, reports an increase of 4,534 consumers during 1934-35, bringing the total number at March 31st, 1935, to 46,757. This development was largely due to the rental wiring system. Considerably more use was made of the Corporation's hire facilities, the number of cookers in circuit increasing by 679 (4,661 on hire), kettles by 105 (943), water heaters and wash boilers by 319 (2,869), and immersion heaters by 170 (841). The number of fires hired out decreased from 1,262 to 1,156; this is possibly the result of people buying their fires outright, as so many attractive models are now obtainable at a small cost.

SUB-STATIONS AND EQUIPMENT.—A loan of £10,000 for sub-stations and equipment has been sanctioned.

EXTENSIONS.—The Electricity Committee has prepared a scheme for extensions estimated to cost £92,850.

Colchester.—FRINGE ORDER.—The Corporation proposes to apply to the Electricity Commissioners for a Fringe Order to supply electricity to the village of Goldhanger. The County of London Electric Supply Co., Ltd., the statutory undertakers for the district, raise no objection.

Darlington.—NEW MAINS.—The Town Council is to lay h.v. mains in Swaledale Avenue, Brinkburn Road, Coniscliffe Road, Brinkburn Drive, Hartford Road, and The Causeway, &c. L.v. mains are to be laid in Grange Road and Bondgate, Darlington.

Electric-discharge lighting in Broad Street, Leominster

Dundee.—TURNING TO ELECTRICITY.—Of the 312 municipal houses originally provided with gas lighting, 131 have now been equipped with electrical installations at the tenants' expense. In view of this indication of preference for electricity the Housing Factorial Committee recently discussed the provision of electric lighting in those houses still supplied with gas, and it was decided that a plebiscite should be taken to ascertain whether the tenants concerned want electricity.

Eston (Yorks).—EXTENSIONS.—Mains are to be extended to Normanby by the Electricity Committee. The cost, including a sub-station, is estimated at £2,800.

Exeter.—DOMESTIC DEVELOPMENTS.—An application by the Electricity Committee to borrow £10,000 for the purchase of domestic apparatus for hire purposes has been granted. The Committee has expended a loan of £2,000 for the provision of wiring for cookers and heaters and application is to be made for sanction to borrow a further £3,000 to cover similar expenditure during the next two or three years.

Finland.—EXTENSION OF IMATRA POWER PLANT.—The Swedish General Electric Co. (Asea), has recently completed a 29,000 kVA vertical-shaft generator for the State hydro-electric station at Imatra, making the fifth "Asea" alternator installed there. The new machine, although of the same main dimensions as the four sets already installed, represents an increase in the unit capacity of over 25 per cent., and brings the capacity of the station up to 125,000 kVA.

Glasgow.—CHANGE-OVER.—The Health Committee has approved of £1,625 being spent on converting the electrical plant at Belvidere and the Eastern and Western District Hospitals from d.c. to a.c.

Gravesend.—SUMMER CONCESSIONS.—During the summer quarters the running charge under the Corporation's two-part tariff is being reduced to ½d. per kWh, and the domestic charge to ¼d. per kWh.

Greenock.—OVERHEAD LINES.—The Corporation has received permission for the erection of 10,000 V overhead lines between Greenock and Gourock.

Greenwich.—ELECTRIC LIGHTING FOR FLATS.—Electric lighting is to be installed in ninety-four flats to be erected in the Lamb Lane area.

Guildford.—SUPPLY EXTENSION.—The provision of a supply to Thornsombe at an estimated cost of £2,250 is being considered by the Electricity Committee.

Hull.—PLANT EXTENSIONS.—It is proposed to extend the local generating station at a cost of £279,618, and to provide new distributing mains (£41,000). It is expected that the new plant will be in full commission by September, 1938, at the latest.

India.—CALCUTTA PROGRESS.—Figures published by the Calcutta Electric Supply Corporation, Ltd., show that 263 million kWh of electricity was sold by the company during 1935. This is an increase of 33 million kWh over the sales during the previous year.

Inverness.—PROGRESS OF THE UNDERTAKING.—In a review of the municipal electricity undertaking's progress during 1935, the *Inverness Courier* states that a record peak load of 1,928 kW was reached on December 23rd, while the 4.2 million kWh generated during the year represented an increase of 20.9 per cent. Over three hundred new houses were wired and connected to the mains, and a large number of appliances were hired out. A supply of 45,000,000 lb. of steam from the destructor plant helped to keep fuel costs low, and for the fourth consecutive year there were reductions in charges. The engineer and manager is Mr. G. A. Maclean.

Leominster.—STREET LIGHTING.—One of the latest street-lighting installations to be undertaken by the Simplex Electric Co., Ltd., is at Leominster, where Broad Street is lighted by means of 400-W Met-Vick. mercury-vapour electric-discharge lamps in type L1721 lanterns. This is one of the few installations in the country employing centrally suspended lamps of this type. The whole of the lighting in Leominster was changed over from gas to electricity recently, the scheme being prepared by the Simplex Company in conjunction with the Leominster Electric Supply Co., Ltd.

London.—HAMMERSMITH.—The replacement of the e.h.v. switchgear at Cadby Hall at a cost of £3,061 is recommended by the Electricity Committee.

POPLAR.—Sanction to borrow £35,000 for mains, £35,000 for services, £31,000 for meters, £46,000 for installations, and £30,000 for sub-station equipment is being sought by the Electricity Committee, which is also to provide a sub-station in Rothbury Road at a cost of £2,200.

The Electricity Committee has given consideration to the institution of a water-heating scheme, and the borough electrical engineer suggests that 1½-gal. water heaters could be offered to consumers at a tariff comprising a fixed charge of 1s. per calendar month and a running charge of ½d. per kWh.

ST. PANCRAS.—Additional equipment is to be provided by the Electricity Committee at the King's Road sub-station at a cost of £2,126.

TWICKENHAM.—The London and Home Counties Joint Electricity Authority is to erect a transformer station on the Rosalind estate and a transformer kiosk adjoining new flats in Chertsey Road.

BERMONDSEY.—The Electricity Committee is seeking sanction to borrow £10,000 for mains and services, £3,000 for meters, £10,000 for "free" wiring, and £2,000 for apparatus. It is also to provide a transformer sub-station costing £407 at the new Health Centre in Grange Road.

ST. MARYLEBONE.—An estimate of £10,000 for extensions to the a.c. supply has been approved by the Electricity Committee.

WANDSWORTH.—The Borough Council has decided to light sixteen miles of its main roads by electricity for the first time.

STEPNEY.—Economies effected at the generating station led to a reduction in works costs during the year ended March 31st last, and the total expenses only rose by £6,124 to £206,212, compared with an increase of £34,782 to £476,593 in the gross revenue. The net surplus, after allowing for interest on loans, &c., was £52,155 (£24,743 in 1933-34). Mr. A. E. Campbell, the borough electrical engineer and general manager, reports that 103.1 million kWh was generated during the year, the net supply to the undertaking being 105.7 million kWh, and sales amounted to 83.2 million kWh, as compared with 80.9 million kWh in 1933-34. The amount of electricity sold within the borough increased by 4.6 million kWh (or 7.18 per cent.), a result which Mr. Campbell describes as

satisfactory and encouraging, reflecting general improvement in all classes of supply. The maximum load carried by the generating plant was 47,200 kW—5,790 kW (or 14 per cent.) more than 1933-34. During the year 5,154 applications were received for new supplies and reconnections, 2,163 for extensions of existing installations, and 3,379 for transfers. The number of employés engaged in the undertaking at March 31st last was 750, representing an increase of forty-one during the year.

Newcastle-upon-Tyne.—ACQUISITION PROPOSAL.—A special sub-committee of the Transport and Electricity Committee has decided to recommend the Corporation to exercise, forthwith, its powers to acquire the distribution mains and plant of the Newcastle & District Electric Lighting Co. in the Benwell and Fenham districts. It is contended that the Corporation would be able to make reductions in the cost of electricity to consumers.

New Zealand.—£300,000 HYDRO-ELECTRIC SCHEME.—It is reported in the *New Zealand Electrical Journal* that, after many months of negotiation, agreement has been reached between the various bodies concerned with the proposals for the establishment of a major hydro-electric scheme for the Nelson Province, and the New Zealand representative of the Hume Pipe & Concrete Construction Co., Ltd., of London, has informed the Waimea Power Board and the Nelson City Council that the company has granted authority for work on the Cobb River scheme to commence immediately. The construction of the power station is to be undertaken by Messrs. Vickerman & Lancasters, consulting engineers, and is estimated to cost approximately £300,000. The initial generating capacity will be 4,000 kVA. and it is proposed to increase this to 16,000 kVA later.

The Midland Bank, Manchester, lighted by specially designed G.E.C. fittings

North Lincolnshire.—FURTHER EXTENSIONS.—The North Lincolnshire & Howdenshire Electricity Co., Ltd., has notified the Isle of Axholme Rural District Council that it intends to erect overhead lines at Keadby and Althorpe.

North Metropolitan Area.—LOWER CHARGES.—The North Metropolitan Electric Power Supply Company, which supplies electricity in an area of 660 square miles in Hertfordshire, Middlesex and Essex, has announced that the "unit" charge on the all-in rate will be reduced to ½d. throughout the year in all accounts rendered on and after February 1st, 1936. The effect of this reduction is that the charge is reduced from ¾d. in the winter and ½d. in the summer in Edgware, Edmonton, Enfield, Harrow Weald, Kenton, Kingsbury, Southgate, Stanmore, Tottenham, Wembley, Wealdstone, and Wood Green, and from 1d. in the winter and ½d. in the summer in the remainder of the company's area. The fixed charge on this rate was reduced in all the above districts at the beginning of 1935. These reductions do not affect Harrow, which is served by the Harrow Electric Light & Power Co., Ltd., a subsidiary of the North Metropolitan Co.

Prescot.—LIVERPOOL CORPORATION GIVEN PERMISSION TO PURCHASE UNDERTAKING.—The Ministry of Transport has confirmed the Special Order submitted by the Electricity Commissioner under which the Liverpool Corporation is granted powers, among other things, to purchase the Prescot electricity undertaking, which is at present owned by British Insulated Cables, Ltd. A provisional agreement to this effect has already been made between the Liverpool Corporation and the company.

Rawtenstall.—AMENDED CHARGES.—A new scale of charges, estimated to cost the Corporation £1,430 a year, is to come into operation on April 1st. The maximum lighting charge is being reduced to 5d. per kWh, while the Norwich scale is to be replaced by a domestic tariff of 12½ per cent. of the rateable value of premises per annum, plus 0.525d. per kWh for the first 400 kWh per quarter and 0.35d. per kWh for further energy consumed. There is to be a combined lighting, heating and power tariff for business premises of £4 per quarter per kW installed, plus 0.525d. per kWh. For industrial heating, including vehicle-battery charging, where supplies are taken between certain hours, 0.425d. per kWh is to be charged. Shop-window lighting between specified hours is to be charged at the same rate (1½d. per kWh) as outside signs. Power rates are being revised.

Southend-on-Sea.—THIS YEAR'S ILLUMINATIONS.—It is proposed that this year's illuminations shall commence on August 1st and continue until October 18th.

Stockport.—REVISED CHARGES.—Under the alternative rate for long-hour lighting consumers the charge has been reduced to a fixed amount of £3 per annum per kW of maximum demand for ordinary lighting, plus 1½d. per kWh for all electricity consumed.

Sweden.—POWER SCHEMES.—Among the allowances for investment purposes proposed in the Swedish Budget estimates for the financial year 1936-1937 are several amounts for the Government-owned water-power system. A grant of Kr.2,500,000 is requested for the construction of the new hydro-electric power station on the Stadsforsen (Indalsälven river); this is estimated to cost Kr.15,000,000, and preparatory work has already been started. In addition, Kr.4,500,000 is required for continued work on the main power distribution line between Porjus, in the northern power system, and Västeras, in the central Swedish system, and Kr.6,000,000 for the establishment of other new plant and lines. The development of the Porjus and Trollhättan power stations will be continued and a new canal for the supply of water to the Vargön power station (on the Göta river) will be built.

United States.—GENERATION IN 1935.—The American journal *Power* states that an increase of nine thousand million kWh in the output of public utility plants ranks as an outstanding achievement of the electrical industry in 1935. This expansion was exceeded only in 1929, when 9.5 thousand million kWh was added. The amount of electricity generated was approximately 99 thousand million kWh, 40 per cent. of which was derived from hydro-electric power plants.

West Hartlepool.—LOANS.—Application has been made by the Town Council for sanction to borrow £343 for the erection of a sub-station and £2,506 for equipment.

Winsford.—BOARD OF TRADE INQUIRY.—An inquiry was held recently at Winsford regarding a Special Gas Order which the Council is applying for to enable it to supply the parish of Clive and part of Stanthorne, which will shortly be included

The Rating of the Lochaber Scheme

THE Lands Valuation Appeal Court gave judgment at Edinburgh on January 24th in rating appeals by the North British Aluminium Co., Ltd., and the Lochaber Power Co. The Aluminium Co. appealed against the entries in the valuation roll for the parish of Kilmonivaig, Inverness-shire, in respect of its factory, workshops, stores and offices of the figure of £8,772 gross annual value and £2,056 rateable value. The company claimed that the gross annual value should be entered at £1,600 and the rateable value at £375. The Lochaber Power Co. appealed against the entry of £132,544 as the gross annual value of its hydro-electric power works and £2,500 in respect of the pier and part of the pier railway at Fort-William, and £31,065 rateable value in respect of the works and £586 in respect of the pier. It maintained that the £132,544 should be reduced to £15,750, and the £31,065 to £3,691 10s., and that the £2,500 should be reduced to £250, and the £586 to £58 10s.

On behalf of the Aluminium Co. it was contended that its undertaking and that of the Power Co. should be treated as one industrial whole; that, upon a comparison with similar undertakings, the percentages applied by the Assessor were excessive, and if upheld would result, under present conditions, in the aluminium being produced at an uneconomic figure; and that a fair figure for the two undertakings would be £73,600, of which £1,600 might be taken as referable to the factory undertaking. The hydro-electric scheme and the aluminium factory were materially interdependent, and together they constituted one industrial unit. The appellants' undertaking fell to be valued upon a comparison with similar undertakings in the Highlands districts of Scotland and Wales which had been in existence and had settled valuations for many years. The Assessor had employed percentages comparable with those applied to factories in the industrial belt of Scotland, which were excessive and unwarranted as applied to the appellants' undertakings.

For the Assessor it was held that the factory and the power works were separate and distinct hereditaments, and that he had applied the usual percentages. To apply lower percentages would give an undue preference in comparison with other industrial concerns throughout the country. With regard to the appeal of the Power Co. it was stated that during the construction of the works and until the current year no principle of valuation had been applied to the undertaking, and the figure appearing in the roll was merely an agreed one between the company and the then Assessor.

The Court refused both appeals.

in the urban area, and also areas at Bostock, Darnhall, Marton and Little Budworth. The Mid-Cheshire Electricity Co. opposed but stated that it had no objection to the supplying of gas to areas which would be included in the new urban district. The company pointed out that the capital cost of rural extensions was so great that there was not room for both in the same villages. Counsel for the local authority is reported to have stated that this was the first case of its kind for twenty-two years. In twenty-nine years there had only been two cases in which electricity interests had opposed the extension of limits for gas and both of these were lost.

Worthing.—REMOVAL OF PYLONS SOUGHT.—In 1932 the Minister of Transport granted conditional permission to the Central Electricity Board for a line of pylons to be erected between Worthing and Littlehampton, and the work was duly carried out. Mr. A. Bates, the owner of the Field Place estate, has since applied for revocation of the Minister's authorisation so far as it affects his estate, and the matter was investigated at an inquiry held on January 21st. For Mr. Bates it was claimed that the pylons interfered with the proposed laying out of a building scheme covering the erection of 2,500 good-class houses. He was not prepared to accept compensation in lieu of removal of the pylons. The Worthing Town Council was not officially concerned, but the town clerk was called in support of the application. He said that the Council's cables were all placed underground. The inspector (Col. Tucker, O.B.E.) referred to the attitude of the Council at the previous inquiry, and said that the Ministry never issued consent for overhead lines without first ascertaining that the local authority did not wish to be heard. The town clerk said the Corporation considered that the position had materially altered. Nobody could have foreseen the rapidity of development. The Council thought that the consent was only for a limited period. On behalf of the C.E.B. it was stated that Mr. Bates bought the land in 1934 when the lines were up and he did not know that he could possibly get them removed. If the lines were placed underground, the minimum cost to the Board would be £10,000. There were 2,000 houses in the country which came directly underneath overhead lines.

Yarmouth (Norfolk).—YEAR'S PROGRESS.—We have received a copy of the annual report and accounts of the electricity undertaking for the year ended March 31st, 1935. Mr. P. E. Rycroft, the engineer and manager, states that this was the first full year in which the station operated under the grid system. During the year 2,078 new consumers were connected, bringing the total on circuit to 26,001, and the output of electricity increased by 9.36 per cent. In the same period 713 cookers, 164 water heaters and 75 wash-boilers were hired out, the total connections at March 31st last being 2,532 cookers, 405 water heaters, and 192 wash-boilers.

Traction

Australia.—BRISBANE TRAMWAYS REPORT.—A considerable improvement in the financial position of the undertaking as compared with the previous year is shown in the annual report for 1934-35 of the City Council's Tramways and Power House Department, of which Mr. G. R. Steer is the general manager. Traffic revenue increased from £669,630 to £711,448, and working expenses from £488,865 to £530,285, the net profit (£21,970) being up by £9,300. Notwithstanding this improvement the traffic revenue was still £79,091 less than in the peak year (1928), when 650,549 more tickets were issued than in 1934-35. The increase in tickets issued during 1934-35 over 1933-34 was 10 per cent. (7,000,000), making a total of 77,052,715 for the year. The engineer remarks that the intensity of the peak loading in Brisbane is remarkable; the number of cars in the regular all-day service is increased by 136 per cent. in the morning and 191 per cent. during the afternoon peak which, in the city, lasts only for about forty-five minutes. He believes it to be due, in a large measure, to the fact that retail shops now close at 5.30.

Darlington.—MORE TROLLEY-BUS ROUTES.—The Town Council is to promote a Provisional Order authorising it to run trolley-buses along additional routes in the town.

London.—ST. MARYLEBONE.—The provision of further traffic signals at a cost of £15,200 is to be undertaken by the Highways Committee.

L.M.S. Railway.—COLOUR-LIGHT RAIL SIGNALLING.—The semaphore signals on the L.M.S. railway between Carlton Road Junction (Kentish Town) and Finchley Road (West Hampstead) on the main line from St. Pancras are to be replaced by colour light signals.

Communications

Denmark.—RADIO LICENCES.—Our Copenhagen correspondent reports that there are now 609,226 registered radio listeners in Denmark out of a population of 3½ millions.

Great Britain.—TELEPHONE LINK WITH CENTRAL AMERICA.—The Postmaster-General announces that a telephone service is now available to all parts of the Dominican Republic and to parts of Honduras.

DIRECTION FINDING BY RADIO.—It is reported that a £2,500 radio direction-finding station is to be erected at the Southampton Airport at Eastleigh.

NEW EQUIPMENT FOR BARRA LIGHTHOUSE.—New radio equipment is to be installed at the Barra Head Lighthouse, Scotland.

Jugoslavia.—A LONG SUBMARINE CABLE.—The laying of a 1,500-mile long submarine cable from Igal will, by the end of August, put Jugoslavia into direct communication with Australia, Africa and America, and Bulgaria, Rumania, Greece and Turkey will be linked with these countries by telephone and telegraph.—*Reuter.*

Sweden.—RADIO LICENCES.—A record increase of about 100,000 in the number of radio licences issued during 1935 is reported. This increase is 50 per cent. higher than during any of the nine preceding years, and Sweden is now rapidly approaching the level of Denmark and Great Britain as regards the number of sets in proportion to the population. Three months ago Sweden had 129.2 sets per 1,000 inhabitants against Denmark's 163.1 and Great Britain's 153.7. The number of licences in use on December 31st was 833,000.

TELEVISION.—Television programmes were begun recently in Stockholm by the Svenska Radioaktiebolaget. According to our Scandinavian correspondent transmissions are made from the suburb of Alstromergarten, television being radiated on 6.97 metres and sound on 7.31 metres; 240-line definition is used, and transmissions are made daily between 2 and 4 p.m. Receivers designed by the firm's own engineers are already on the market at a cost of £50, and give pictures measuring 24 by 18 centimetres.

A Swiss Railway Maintenance Unit

THE accompanying illustration shows a new type of self-propelling truck which has recently been put into service by the Swiss Federal Railway authorities. The vehicle is chiefly intended for arc-welding and metal cutting on railway lines, but it is also being used to supply electricity to the motors of travelling cranes, compressors, drills, &c., when work is being carried out on bridges and superstructures, and during the night it provides energy for illuminating the working site. Among other duties which it fulfils are, for example, battery charging, melting frozen water pipes, warming transformers and rectifier cylinders, supplying electricity for magnet clamping devices, line inspection, and for the supervision of contact wires, &c. These duties are performed with the help of a simple electrical equipment, the main parts of which comprise a d.c. generator, a traction motor and a change-over controller. The chassis of the vehicle was built by Ateliers de Construction Mécaniques, while the electrical equipment was manufactured and installed by the Brown-Boveri Co. The generator is a standard welding dynamo designed for a terminal voltage of 35 to 65 V and a welding current of 50 to 250 A. The power is supplied by a petrol engine developing 20 h.p. at 1,500 r.p.m. The voltage required for lighting circuits (about 110 V) is attained by increasing the speed of the generator set to 2,200 r.p.m.

The travelling arc-welding and general railway maintenance unit

A spray-waterproof, series-wound traction motor is suspended in the vehicle frame and drives one of the axles through a cardan shaft and worm drive. The regulation of travelling speed is carried out by voltage variation with the help of the field regulator in the excitation circuit of the generator. A maximum speed of 28 m.p.h. is attainable. In order to avoid travelling backwards over long distances the vehicle is equipped with a raising and rotating device enabling it to be turned round at any point.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Amble.—February 12th. Electricity Department. One 20,000-V switch, one 150-kVA transformer, l.p. distribution board, instruments, and auxiliary sub-station equipment, cables, &c. (See this issue.)

Ardsley.—February 29th. U.D.C. Supply of electric lamps for street lighting for a period of one year ending March 31st, 1937. F. A. Brown, Council's surveyor, Council Offices, Tingley.

Argentina.—BUENOS AIRES.—March 9th. State Oilfields Directorate. Construction and equipment of an electric generating station, with Diesel-engine driven alternators and associated equipment, at the Storage Depôt, San Lorenzo. (T.Y. 10366.)*

Australia.—BRISBANE.—April 17th. City Electric Light Co. Automatic outdoor-type booster transformers. (T.Y. 10321.)*
April 24th. 1,943 yd. of underground cable. (T.Y. 10323.)*

Bathavon.—February 14th. R.D.C. Electrically driven pumping plant consisting of two electric motors and switchgear and horizontal-spindle centrifugal pumps. Willcox, Raikes & Marshall, 33, Gt. Charles Street, Birmingham (deposit £2 2s.).

Bexhill.—February 5th. Electricity Department. Collection, conversion and re-installation of d.c. wireless apparatus. (January 24th.)

Birmingham.—February 5th. Salvage Department. Four electric battery driven refuse collection vehicles. (January 24th.)

Bootle.—February 7th. Corporation. Supply of electric lamps for twelve months commencing April 1st next. Borough engineer's office, Town Hall.

Bristol.—February 17th. Electricity Department. E.h.p. and l.p. switchgear, and transformers. (See this issue.)

Bromley (KENT).—February 10th. Electricity Department. L.p., e.h.p., and pilot cable. (See this issue.)

Caithness.—February 1st. County Council. Heating and electrical work for additions and alterations at Wick High School. Sinclair Macdonald & Son, architects, Wick (deposit £2 2s.).
February 15th. Electric lighting at fifty houses in the County. Sinclair Macdonald & Son (deposit £2 2s.).

Cardiff.—February 11th. R.D.C. Electricity Department. Electrical goods for one year. (See this issue.)
February 11th. King Edward VII Welsh National Memorial Association. X-ray equipment for the Sully Hospital and the Pontypridd Tuberculosis Clinic. F. J. Alban, secretary, Memorial Office, Westgate Street.

Cheshire.—County Public Assistance Committee. Firms desirous of being placed on the official list of contractors for supply of electric lamps to various institutions, &c., should apply to W. H. Owen, Public Assistance Officer, Bridgegate House, Chester.

Cheadle & Gatley.—February 14th. Electricity Department. Materials for one year. (See this issue.)

Dagenham.—February 3rd. Engineer and Surveyor's Department. Electrical installations on housing estate. (January 17th.)

Dundee.—February 12th. Electricity Department. Cable. (See this issue.)

Epsom & Ewell.—February 17th. Electricity Department. L.p. cable. (See this issue.)

Erith.—February 26th. Electricity Department. Twenty-unit 2,840-V switchgear and alterations to existing 22,000-V switch units. (January 24th.)
March 2nd. Materials for twelve months. (See this issue.)

Fife.—February 8th. County Council. Heating and electrical work at the new Junior Instruction Centre, Buckhaven. G. Sandilands, County master of works, Property and Works Department, Education Offices, Wemyssfield, Kirkcaldy (deposit £1 1s.).
February 10th. Heating and electrical work at new High school, Dunfermline. C. R. Douglas & Son, Prudential Buildings, East Port, Dunfermline (deposit £2 2s.).

Glasgow.—February 6th. Corporation. Electrical work at a school and a child welfare clinic. Office of Public Works, Room 81 (deposit £2 2s.).
February 13th. Electrical installations in 836 houses and seven shops at Househill Wood. Town Clerk's Office, Room 36.

Halifax.—February 10th. Improvement Committee. Various works, including electrical, at the King Cross Street development—maisonettes, Block "B." D. T. Lloyd Jones, borough engineer, Crossley Street (deposit £2 2s.).

Hastings.—February 10th. Electricity Department. Materials for three years. (January 17th.)
February 13th. Public lighting tower wagon. (See this issue.)

Hornsey.—February 18th. Electricity Department. Two 500-kW motor generator sets, two e.h.p. switches, two e.h.p. feeder switches, and one d.c. feeder switchboard. (January 24th.)

Hove.—February 5th. Borough Council. Electric lamps. Office of the borough surveyor.

Hoylake.—February 1st. U.D.C. Automatic electrically driven pumping plant, including pumps, motors, starting gear, &c., in connection with the Lower Green pumping station. W. H. Maitland, Town Hall.

Lanark.—February 4th. County Council. Various works, including electrical, at 112 houses. P. C. Smith, County housing and town planning engineer, 13, Clydesdale Street, Hamilton.

Leeds.—February 14th. Electricity Department. Goods for one year. (See this issue.)

Lincoln.—February 1st. Electricity Department. Materials for twelve months. (January 17th.)

Liverpool.—February 3rd. Port Sanitary and Hospitals Committee. Engineers' and electrical supplies. Town Clerk's Office, Municipal Buildings, Dale Street.

London.—KENSINGTON.—February 8th. Borough Council. Electrically propelled tractors. (January 17th.)
BATTERSEA.—February 12th. Electricity Department. Materials for one year. (January 24th.)
METROPOLITAN WATER BOARD.—February 6th. Three electrically driven automatic centrifugal pumps with electric starters, &c., at the Putney Heath Works, S.W.15. Chief engineer, Offices of the Board, 173, Rosebery Avenue, E.C.1 (deposit £2 2s. to the accountant of the Board).
STOKE NEWINGTON.—Electricity Department. Electrical material and apparatus for one year. (January 24th.)

Manchester.—February 11th. Transport Committee. Cables, wire, armature and field coils, switches, conduit, cells, controller fingers, insulation material, carbon brushes, overhead equipment material, electrodes, &c. General manager, Transport Department, 55, Piccadilly.

Middlesex.—February 12th. County Council. Switchboard at Harefield Sanatorium. (January 17th.)

Musselburgh.—February 3rd. Town Council. Various works, including electrical, at the King's Park housing scheme. Borough surveyor.

Newcastle-upon-Tyne.—February 8th. Housing Committee. Repair and maintenance of electric lighting on Corporation housing estates. Housing architect, 18, Cloth Market.

New Zealand.—WELLINGTON.—April 21st. Public Works Department. Three 10,000-kVA oil-immersed, self-cooled, single-phase transformers with accessories for the Penrose sub-station. (T.Y. 10354.)* 110-kV and 50-kV switchgear. (T.Y. 10355.)*
March 9th. Post and Telegraph Department. Motor generator ringing sets. (T.Y. 10349.)*
March 3rd. Twenty miles of telephone cable. (T.Y. 10341.)*

Northern Ireland.—BELFAST.—February 14th. Electricity Department. Replating regulating cells of storage battery at Harbour power station. (See this issue.)

Plymouth.—February 8th. Electricity Department. Meters, time-switches, cables and wireless rectifiers. (January 17th.)

Radcliffe.—February 18th. Electricity Department. E.h.p. and l.p. cables and e.h.p. sub-station switchgear. (January 24th.)

Roxburgh.—February 5th. County Council. Electric lighting at the County Isolation Hospital, Newstead. County clerk, County Offices, Newtown St. Boswells (deposit 10s. 6d.).

St. Albans.—February 11th. City Council. Electrical installation for extensions to the Sisters' Infectious Hospital, Folly Head. (January 24th.)

Salford.—February 19th. Corporation. Stores. (See this issue.)

Sheffield.—February 14th. Electricity Department. 33-kV switchgear. (See this issue.)

South Africa.—PRETORIA.—February 28th. Union Tender and Supplies Board. Telegraph and telephone line material. (T.Y. 10362.)*

Southport.—February 3rd. Electricity Department. E.h.p. switchgear. (January 24th.)

Staines.—February 8th. U.D.C. Two sets, each in duplicate, of pumps, electric motors, switchgear, &c. D. C. Fidler, engineer, Bridge Street.

Stoke-on-Trent.—February 5th. N.W. Midlands J.E.A. Transmission lines, transformers, painting chimney stacks, spraying cooling towers, &c. (January 17th.)
February 12th. Electrical Engineer's Department. E.h.p. sub-station switchgear, transformers, mains and cables. (See this issue.)

Stretford.—February 1st. Borough Council. Supply of electric lamps for twelve months from April 1st next. Town clerk, Town Hall.

Sunderland.—R.D.C. Electric lighting at the Infectious Diseases Hospital, Hylton Road. Surveyor, Council Offices, 17, John Street.

Swansea.—February 3rd. Education Committee. Electric lighting and heating installations in the new gymnasium and handicraft rooms of the Training College. Borough architect, Guildhall (deposit £2).

Thornton Cleveleys.—February 7th. U.D.C. Four 500-kVA transformers. (January 24th.)

Torquay.—February 3rd. Corporation. Supply of electric lamps, &c., during the period beginning April 1st next. Borough engineer.

Wimbledon.—February 10th. Two 1,000-kVA and twenty 200-kVA transformers. (See this issue.)

Winchester.—February 12th. Electricity Department. Underground cables for twelve months. (January 24th.)

Worcester.—February 15th. Electricity Department. Cables, conductors, transformers and meters for twelve months. (January 24th.)

Worthing.—February 6th. Corporation. Street lighting equipment. (January 17th.)

* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Audenshaw.—U.D.C. Accepted. Electrical work at Ryecroft Hall (£235).—J. Lomax Kendal & Co., Ltd.

Australia.—COMMONWEALTH.—P.M.G.'s Department. Accepted. Cable (£1,503).—Standard Telephones & Cables (A'sia), Ltd. Protective apparatus (£352).—Phœnix Telephone & Electric Works, Ltd. Condensers (£186), carrier telephone equipment (£8,029), and automatic switching equipment (£331).—British General Electric Co., Ltd. Automatic switching equipment (£754).—Automatic Telephones, Ltd.

SYDNEY.—Municipal Council. L.p. cable (£2,855) and h.p. cable (£4,431).—Siemens (Aust.) Pty., Ltd.

BRISBANE.—City Council. Insulated copper cable (£1,319).—Siemens (Aust.) Pty., Ltd.—*Tenders.*

Barnes.—Town Council. Accepted. Cable (£171).—Hackbridge Cable Co., Ltd.

Clydebank.—Fire and Lighting Committee. Recommended. Installation of electric lighting for common closes and stairs.—J. Kilpatrick & Sons, Ltd. This installation includes 1,002 "Sharborn" automatic relay switches manufactured by Messrs. H. J. Osborn & Sharp, Ltd. Stairlighting brackets.—General Electric Co., Ltd.

Glasgow.—Education Committtee. Accepted. Electric tubular heaters for Mosspark school.—Unity Heating, Ltd.

Housing Committee. Accepted. Electrical installations in 118 houses on the Ardgay Street housing schemes (£512).—R. J. McIntyre.

Sub-Committee on Properties. Accepted. Telephones for the city engineer's and master of works' department, Municipal Buildings (£131).—Dictograph Telephones, Ltd.

Water Committee. Accepted. Electrification of Brenachoil Lodge (£857).—A. Ritchie.

Hertfordshire.—Public Assistance Committee. Accepted. Electrically operated lift at Shrodells Institution Hospital, Watford (£338).—W. Wadsworth & Sons, Ltd.

Hitchin.—R.D.C. Accepted. Electric lighting at thirty-four houses (£291).—E. A. Heap (Knebworth).

London.—HAMMERSMITH.—Electricity Committee. Recommended. Two 250-kW, three-phase, oil-cooled transformers for providing an electricity supply to new flats in Shepherd's Bush Road (£153 each).—General Electric Co., Ltd.

POPLAR.—Contracts Committee. Recommended. One 6,000-kW turbo-alternator (£11,977).—Metropolitan-Vickers Electrical Co., Ltd. Water heaters (£3 each).—General Electric Co., Ltd. Two 500-kVA transformers (£357) and e.h.p. switchgear (£525).—Johnson & Phillips, Ltd. L.p. switchgear (£123).—English Electric Co., Ltd.

METROPOLITAN WATER BOARD.—Recommended. One 80-kW electric generator (£1,754), one vertical spindle borehole pump (£1,779), one surface pumping set (£1,376), and one horizontal low-lift pump (£866).—W. H. Allen, Sons & Co., Ltd. One 160-kW electric generator (£2,978).—Davey Paxman & Co. (Colchester), Ltd. One vertical spindle low-lift pump (£1,200).—Pulsometer Engineering Co., Ltd.

STEPNEY.—Electricity Supply Committee. Recommended. Supplies during the period ending December 31st, 1936: Cut-outs (£580).—W. T. Henley's Telegraph Works Co., Ltd. Switches (£240).—C. H. Parsons, Ltd. Electric delivery van (£237).—Electricars, Ltd.

STOKE NEWINGTON.—Electricity Committee. Recommended. Rising mains for the Lordship Terrace-Queen Elizabeth's Walk flats (£450).—Anderson, Angell & Co. Messrs. Howes & Jackman, architects for the proposed housing scheme, have accepted the tender of Messrs. Anderson Angell & Co. for electrical installations in the above flats.

Sunderland.—Town Council. Accepted. Two electric lifts at the Municipal Hospital (£870).—Etchells Congden & Muir, Ltd. Electric cookers for hiring purposes during the next three years.—General Electric Co., Ltd.

Wallasey.—Electricity Committee. Accepted. Reactor (£172).—General Electric Co., Ltd. Switchgear.—English Electric Co., Ltd. (£457); Metropolitan-Vickers Electrical Co., Ltd. (£343).

Forthcoming Events

Institution of Electrical Engineers.—Monday, February 3rd. Institution, London. 7 p.m. Informal meeting. Discussion on "The Superimposition of Carrier Waves on Distribution Systems." To be opened by Mr. H. P. Barker.

South Midland Centre.—Monday, February 3rd. James Watt Memorial Institute, Birmingham. 7 p.m. "The Effect of Legislation and Regulations upon Electricity Distribution." Mr. W. Fennell.

East Midland Sub-Centre.—Tuesday, February 4th. University College, Nottingham. Joint meeting with the Institution of Mechanical Engineers. "The Manufacture of Transformers." Mr. A. C. T. Isaac.

North Midland Centre.—Tuesday, February 4th. Hotel Metropole, Leeds. 7 p.m. Particulars to be announced later.

Wireless Section.—Wednesday, February 5th. Institution, London. 6 p.m. "Electron Optical Systems and their Applications." Dr. V. K. Zworykin.

Meter and Instrument Section.—Friday, February 7th. Institution, London. 7 p.m. "Remote Control of Power Networks." Messrs. G. A. Burns and T. R. Rayner.

Sheffield Sub-Centre.—Friday, February 7th. Royal Victoria Hotel, Sheffield. 7.30 p.m. Annual supper-dance.

Association of Mining Electrical Engineers (*Kent Sub-Branch*).—Saturday, February 1st. Dover Technical Institute. 6.30 p.m. "Electrical Instruments—Their Construction and Use." Mr. F. C. Knowles.

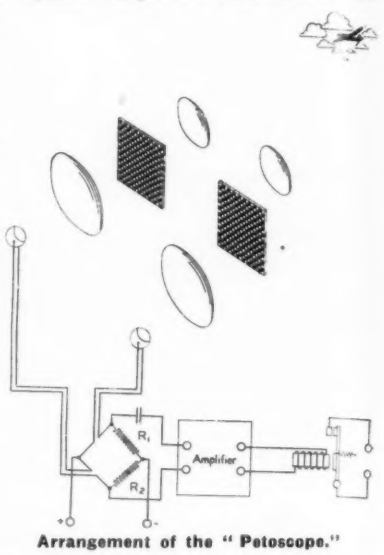
West Wales Branch.—Saturday, February 1st. Swansea. "Choice of Electrical Apparatus for Underground Electrification." Mr. J. Hancock.

Illuminating Engineering Society.—Tuesday, February 4th. Westminster Technical Institute, S.W.1. 7 p.m. Inaugural meeting of the new Photometry Section. Introductory address by Dr. I. W. T. Walsh.

Notes

Photo-electric Detection

A device for the detection by means of photo-electric cells of moving objects (such as an aeroplane or a motor car) that is responsive to specific light effects only, irrespective of variations in general illumination, is described in *Electronics*. The "Petoscope" of Mr. A. S. Fitzgerald consists of a pair of lenses which throw duplicate images of a wide field of view on to two screens divided into small rectangular portions alternately transparent and opaque. The screens have opposite characteristics, *i.e.*, a transparent square in one screen is matched by an opaque square in the other. Light penetrating the transparent parts is concentrated by two lenses on to one (but not both) of two photo-electric cells, so that an object in motion influences the cells alternately at a frequency depending upon its speed. The photo-electric cells are connected in a bridge circuit and are coupled to an amplifier through a condenser. Thus, only a difference between the quantity of light received by the cells will unbalance the bridge and, because of the condenser, only a fluctuating out-of-balance voltage will affect the amplifier. The latter will not respond to changes in daylight intensity, since this is common to both cells.



Arrangement of the "Petoscope."

The inventor says that the "Petoscope" can be made to act selectively by blacking out portions of the screen. The instrument is self-contained and readily portable.

Courses for Teachers

The Board of Education is arranging a course for teachers in recognised technical colleges and schools to be held at New College, Oxford, commencing on July 25th. The primary aims are to consider the most suitable methods of presentation of certain of the subjects taught in National Certificate and City and Guilds courses and to review recent advances in engineering and electrical science and practice, including mathematics. The inclusive charge for board, lodging and attendance for the full eleven days will be £6, the Board to pay travelling expenses above 10s. Further information is obtainable from the secretary of the Board of Education, Whitehall, London, S.W.1.

Electrical Functions

The Institution of Electrical Engineers informs us that its annual dinner will take place on February 13th as arranged, and the Electrical Engineers' Ball will be held on the following evening.

The dinner of the Illuminating Engineering Society has been postponed from February 4th to March 24th.

The South Wales Branch of the Association of Mining Electrical Engineers has postponed its annual dinner from February 15th to March 7th.

The E.I.B.A. (Northern Counties' Section)

The annual general meeting of the Northern Counties' Centre of the Electrical Industries Benevolent Association is to be held at 3 p.m. on February 10th at Grid House, Jesmond Road, Newcastle-upon-Tyne, under the chairmanship of Mr. D. Maxwell Buist.

Engineering Mathematics

A course of lectures on "Bessel Functions and their Application to Engineering" is to be held at the Polytechnic, Regent Street, W.1, starting on February 25th and continuing on twelve subsequent Tuesdays at 7.30 p.m. The lecturer will be Dr. N. W. McLachlan, author of "Bessel Functions for Engineers," and the chairman on the first evening will be Professor E. V. Appleton.

High-definition Television

An illustrated technical description of high-definition television transmission equipment has been published by the Marconi-E.M.I. Television Co., Ltd., which is supplying such equipment for installation in North London for operation by the British Broadcasting Corporation. The booklet describes

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. E. E. Fuller, chief electrical engineer at the Sittingbourne paper mills of Messrs. Edward Lloyd, Ltd., served his apprenticeship with the United Engineering Co. He joined Messrs. Crompton & Co., Chelmsford, as section senior draughtsman, and was responsible for the mechanical and electrical design of generators, and motors and switchgear. Later he went to Messrs. Siemens Bros.' Dynamo Works, Woolwich, as technical designer in the Designs Department. His next appointment was with the British Thomson-Houston Co., Ltd., as commercial engineer in the Power and Mining Department, which dealt with designs and contracts for electrical equipment for steel and iron works, collieries, textile mills, and all kinds of industrial works, and he was also engineer and manager for Scotland. In 1908, he accepted an appointment as chief electrical engineer to Messrs. Edward Lloyd, Ltd., at their Sittingbourne Mills. At that time there was no electrical plant in use other than a small lighting set of 100 kW. Due to conversions and extensions the plant has been enormously increased to the present annual output of over 350,000,000 kWh. Mr. Fuller was responsible for the complete installations, the design and construction of which is described elsewhere in this issue.

[*Elliott & Fry*
Mr. E. E. Fuller

Mr. G. A. Madden has been recommended by the Preston Corporation Electricity Committee for the appointment of station superintendent at the Ribble power station.

Mr. T. A. Kingham, borough electrical engineer, Kingston-on-Thames, has been granted two months' leave of absence on account of ill health.

Mr. S. B. Langlands, inspector of lighting in Glasgow, will retire in July after thirty-two years' service. During this period he has evolved a system of lighting for 600 miles of streets.

Mr. R. S. Whipple, joint managing director of the Cambridge Instrument Co., Ltd., has retired, and a dinner and dance, attended by over 350 people, were given in his honour by the employés of the company on January 18th at the Dorothy Café, Cambridge. Mr. Whipple was presented with a leather-bound album which contained an illuminated address and the signature of each of the 550 employés of the company, and an onyx combined clock and fountain-pen stand, with a leather-bound silver-mounted blotter. Mrs. Whipple was presented with a handbag. In the course of the evening references were made to Mr. Whipple's personal interest in the welfare of the employés, his unfailing courtesy and practical sympathy, and the tradition of close and happy co-operation with the employés which he had fostered. For thirty-eight years, first as secretary, and since 1905 as a managing director of the company, Mr. Whipple had been responsible for many developments and had become a recognised authority on temperature measurement. Mr. R. W. Paul referred to Mr. Whipple's high reputation in the scientific world and to his services to science as treasurer of the Physical Society, one-time president of the Optical Society, and member of the Council of the Institution of Electrical Engineers. In replying, Mr. Whipple reviewed briefly some of the interesting features in the history of the company since he joined the firm as Sir Horace Darwin's assistant in August, 1898. He also referred to the appointment from time to time of various directors, mentioning particularly Mr. C. C. Mason, who joined the board in 1910, and now becomes senior managing director, and Mr. F. Wakeham, who is now joint managing director. At the conclusion of the speeches Mr. Whipple and Mr. Paul, on behalf of the directors, presented a certificate of long service, together with a clock, to each of twenty-seven employés whose continuous service with the firm ranged from forty-seven to twenty-five years. The function concluded with dancing.

The presentation to Mr. R. S. Whipple
Standing (left to right): Mr. W. H. Apthorpe (works director), Mrs. C. C. Mason, Mrs. Apthorpe, Mr. F. Doggett, Mr. F. Wakeham (joint managing director), Miss R. Darwin, Mr. C. C. Mason (joint managing director), Mrs. Wakeham, Mr. R. W. Paul (director), and Mrs. Paul. Seated: Mr. and Mrs. R. S. Whipple

Mr. James N. Wilson, who has been appointed general manager of the Glasgow Corporation Transport Department, in succession to Mr. L. Mackinnon, who is retiring in March, is a native of Rutherglen, and received his education at Hutcheson's Grammar School, Glasgow. He entered the service of the Corporation in 1889, under Mr. John Young, of the Cleansing Department. Some time prior to the Corporation operating the tramways, Mr. Young, who had been appointed tramways manager, transferred Mr. Wilson to the tramways staff as cashier, and in 1901, he was appointed confidential secretary to Mr. Young. He succeeded Mr. Dalrymple as secretary and treasurer when Mr. Dalrymple was appointed general manager in 1904. Shortly after the war broke out in 1914, a comforts fund, inaugurated by the Tramways Department, was placed in the charge of Mr. Wilson, and many requests from the men on the different battlefronts were met out of this fund. During the war the Board of Trade Tramways Committee was formed by the Government to take charge of all the tramway systems in the country, and Mr. Wilson was appointed secretary of this Committee. In February, 1927, Mr. Wilson was appointed deputy general manager

Mr. J. N. Wilson

Notes *(Continued from preceding page)*

the equipment in some detail, including the "Emitron" cameras (which have no moving parts), their control gear and scanning equipment, modulation amplifiers, constant-frequency master oscillator, frequency doubler, five stages of carrier frequency amplification, single stage modulated carrier frequency amplifier, and the aerial system.

Appointments Vacant

Draughtsman for the Air Ministry (Aeronautical Inspection Directorate).

Draughtsman for Eastbourne Electricity Department.

Mains superintendent for Perth Electricity Department.

Telegraph engineer for Posts and Telegraphs Department. Federated Malay States and Straits Settlements.

Head of the Electrical Engineering Department for the Northampton Polytechnic, London, E.C.

Assistant sub-station attendant for Barking Electricity Department.

Engineer in the Borough Engineer's Department, Gateshead.

(See our classified advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

STANLEY insulated switch splitters.

Esco electric fires.

S.E.C. automatic colour-changing clock-wound flood lanterns.

E.T. (in a triangle) bakelite goods.

Readers should enclose stamped addressed envelopes when making their inquiries.

in succession to Mr. Mackinnon, who at that time succeeded Mr. Dalrymple as general manager.

Mr. J. Lawson, who has been acting general manager of the Hull Corporation Transport Department since July last, has been recommended by the Transport Committee for the appointment of general manager at a salary of £1,000 per annum, rising to £1,200.

Mr. F. Lythgoe, manager of the Middlesbrough Corporation Transport Department, has been recommended by the General Purposes Committee for an increase in salary from £750 to £850 per annum, plus a bonus of £100.

Mr. J. A. Beauchemin, A.M.E.I.C., has been appointed engineer of the new Quebec Electricity Commission.

Mr. D. Mackay, power house superintendent, Lochaber power works, was presented with a gold watch by his fellow employés at the Lochaber and Kinlochleven works on the occasion of his retirement under the age limit. Mr. Mackay had been in the employment of the North British Aluminium Co. at Foyers and Kinlochleven, and when the works opened at Fort William he took charge of the power house.

Mr. L. C. Grant, M.I.E.E., of Messrs. Sloan & Lloyd Barnes, is at present in the United States on a business tour. He expects to return at about the middle of February.

Mr. Stavers H. Tiltman, L.R.I.B.A., and **Mr. M. H. Volk,** F.R.Ae.S., who were responsible for the entire planning, layout and design of the Brighton, Hove and Worthing Municipal Airport at Shoreham, have now been appointed by the Leeds and Bradford Joint Airport Committee as architect and aeronautical consultant, respectively, in connection with similar work at Yeadon Aerodrome, Yorkshire.

Obituary

We regret to learn from the Simplex Electric Co., Ltd., of the death of two members of its staff, both of whom were attached to its Midland sales depot, and represented the company in Birmingham and district. **Mr. W. N. Williams,** who died on January 16th, at the age of forty-six, had been in the company's service for four years. He held a commission in the 9th Battalion of the Lancashire Fusiliers during the war, and leaves a widow and two sons. His colleague, **Mr. W. F. Underwood,** who was fifty-seven years of age, passed away on January 24th. Mr. Underwood joined the company thirty-three years ago and during the greater part of that time he represented it in the Central Birmingham district. He leaves a widow and one son.

Mr. H. C. Parsons.—The death occurred recently, at his residence at Twickenham, of Mr. H. Clifford Parsons, who had for some time held an appointment with Rotax, Ltd., of Willesden, N.W. He was previously on the staff of Newtons, Ltd., of Taunton.

Will.—Mr. R. H. Schofield, A.M.I.E.E., a director of Messrs. Ferranti, Ltd., left £10,441 with net personalty £10,259.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Constructional Wireless, Ltd.—Private company. Registered January 4th. Capital, £100 in £1 shares. Objects: To construct and maintain wireless signal stations, and to carry on the business of manufacturers of and dealers in wireless, electrical, and telephone appliances, accessories, &c. The directors are: J. W. C. Robinson, "Green Ginger," Hinchley Drive, Esher, Surrey, and Hubert G. Wells, 55, Upgate, Louth, Lincs. The directors' borrowing powers are restricted to £10,000. Secretary: G. Gamble.

McCarthy Radio, Ltd.—Private company. Registered January 9th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of, agents for and dealers in radio or television apparatus and component parts, manufacturers of and dealers in gramophones, records and musical instruments, engineers, electricians, &c. The directors are: O. W. Beardmore, 148, Inverness Terrace, W.2; and F. S. Drayson, King's Court Hotel, 27, Queen's Gardens, W.2. Registered office: 22, Queen Street, E.C.

Piper Electric Blind Operator, Ltd.—Private company. Registered December 19th. Capital, £100 in £1 shares. Objects: To acquire from Geo. S. Piper, Geo. Eden and John G. Nutting the benefit of a certain existing invention relating to an electric blind, and to carry on the business of manufacturers and repairers of and dealers in electric blinds for motor cars and other vehicles, apparatus, tools, equipment and accessories, and component parts of all kinds, &c. The subscribers are: G. S. Piper, 27, Black Lion Lane, Hammersmith, and three others. Registered office: 1, Lacland Place, Kings Road, Chelsea, S.W.10.

B.B.H., Ltd.—Private company. Registered January 13th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of radio, electrical and photographic apparatus, &c. The directors are: B. B. Hieger, 58, Belsize Avenue, N.W.3, and L. D. Rowan, 20, Ormond Road, N.19. Registered office: 49, Farringdon Street, E.C.4.

Alvan, Ltd.—Private company. Registered January 16th. Capital, £100 in £1 shares. Objects: To carry on the business of exporters and importers of and dealers in electric razors, batteries, &c. The directors are: A. Ferreyros, address not stated, and five others. Solicitors: Le Brasseur & Oakley, 40, Carey Street, W.C.2.

Arnolds (London), Ltd.—Private company. Registered January 16th. Capital, £750 in £1 shares. Objects: To carry on the business of electricians, electrical engineers, manufacturers of and dealers in electrical apparatus, &c. The directors are: L. Arnold and Dorothy E. Arnold, both of 25, Rosslyn Hill, Hampstead, N.W.3. Solicitors: Barlow, Lyde & Gilbert, 165, Fenchurch Street, E.C.3.

Alumilite (Great Britain), Ltd.—Private company. Registered January 24th. Capital, £20,000 in 20 000 7½ per cent. cumulative preference shares of 10s. and 100.000 ordinary shares of 2s. Objects: To acquire an exclusive licence for the U.K. for the use of the "Alumilite" process of treating metals, and to carry on the business of metallurgists and electrical and general engineers, aluminium, iron, brass, bronze, steel, copper, and general metal founders, &c. The subscribers are: S. E. Penhallow, 497, Commonside East, Mitcham, Surrey, and E. H. Wiseman, 8, Severn Avenue, Gidea Park, Romford. Solicitors: J. D. Langton & Passmore, 16, Tokenhouse Yard, E.C.

Lawford, Hovell & Co., Ltd.—Private company. Registered January 24th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in radio, television and all wireless instruments, gramophones, musical instruments, refrigerators, vacuum cleaners, &c. The subscribers are: Mrs. D. Lawford, Ravenslee, Albemarle Road, Beckenham, and Miss K. E. Relton, 23, Ennismore Avenue, Chiswick, W.4. Mrs. D. Lawford is the first director. Solicitors: Baddeley, Wardlaw & Co., 77, Leadenhall Street, London, E.C.

Young Radio & Electrical Engineering Co., Ltd.—Private company. Registered January 23rd. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers, wholesalers, retailers, importers and exporters of and dealers in wireless, television, telephone and telegraph apparatus, &c. The directors are: E. J. C. Young (managing director), 219, Uxbridge Road, Southall, Middlesex, and H. W. Young, 17, Stanwell Road, Ashford, Middlesex. Registered office: 219, Uxbridge Road, Southall, Middlesex.

Stayroid, Ltd.—Private company. Registered January 20th. Capital, £500 in £1 shares. Objects: To carry on the business of mechanical, electrical and radio engineers, lampshade makers, electro-platers, metal and alloy makers, &c. The permanent directors are: A. D. Keighley, 11, Wellington Street, Newton Heath, Manchester, 10, and two others. Registered office: Wellington Street, Newton Heath, Manchester.

Radio & Vision, Co. (Wales), Ltd.—Private company. Registered January 14th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless sets, television sets, &c. The subscribers are: F. W. Cable, 10, Mansel Street, Swansea (first director), and one other. Registered office: 10, Mansel Street, Swansea.

Froggatt Electric, Ltd.—Private company. Registered January 17th. Capital, £6,000 in £1 shares. Objects: To carry on the business of manufacturers of electrical apparatus and fittings, metal workers and contractors, &c. The subscribers are: G. H. Froggatt, engineer, and Mrs. F. M. Froggatt, both of 25, Whiteley Wood Road, Sheffield. G. H. Froggatt is permanent managing director and chairman. Registered office: Emu Works, Eyre Street, Sheffield.

Gainsborough Radio, Ltd.—Private company. Registered January 22nd. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical apparatus, wireless and broadcasting instruments and apparatus, &c. The subscribers are: A. E. Jackson, 1, Oak Timbers, Banstead, Surrey; and W. H. O. Jackson, 18, Wickham Avenue, Shirley, Croydon. W. H. O. Jackson signs documents as director. Solicitor: Arthur R. Cotton, 32/4, High Street, Sutton, Surrey.

Radio-Gram and Television, Ltd.—Private company. Registered January 22nd. Nominal capital, £120,000 in 120,000 6 per cent. non-cumulative participating preference shares of 10s. each and 1,200,000 ordinary shares of 1s. each. Objects: To carry on the business of manufacturers, factors, agents and licensees of gramophones, phonographs and musical instruments of all kinds, gramophone and phonograph records, television apparatus and electrical and wireless apparatus and accessories, record producers, proprietors of record producing studios, &c. The subscribers are: H. W. Brown, 72, Felstead Road, Orpington, Kent; and W. H. Walford, 10, Lambourne Road, Leytonstone, E.11. Registered office: 170, Bishopsgate, London, E.C.2.

Returns of Electrical Companies

Ashton Electrical Co. (Preston), Ltd.—Satisfaction in full on January 8th, 1936, of mortgage or charge dated April 4th, 1932, and registered April 5th, 1932. (According to the register of mortgages the only charge registered April 5th, 1932, was a memorandum of deposit which originally secured all moneys due to bank.)

Mortgage on 8, Tulketh Brow, Ashton-upon-Ribble, Lancs, dated January 8th, 1936, to secure all moneys due or to become due from the company to the District Bank, Ltd. (The above

is in substitution for charge to County Bank, Ltd., dated April 4th, 1932, which has been satisfied.)

Singapore Traction Co., Ltd.—Particulars have been filed of debenture stock to secure £250,000 and premium of 2 per cent. authorised by resolutions of September 18th, and 25th, 1935, and covered by trust deed dated January 9th, 1936, charged on properties in Singapore, and the company's other assets, present and future, including uncalled capital (if any). The amount of the present issue is £175,000. The trustees are: General Investors and Trustees, Ltd., 16, Gracechurch Street, London, E.C.

Satisfaction in full on October 17th, 1935, of trust deed dated July 14th, 1926, and registered July 16th, 1926, securing £250,000 6 per cent. guaranteed 1st mortgage debenture stock. (Notice filed January 10th, 1936.)

Beckett & Parker, Ltd.—Capital, £3,000 in £1 shares (subdivision not stated). Return dated December 14th, 1935. 100 "A" preference, 1,000 "B" preference, 500 "C" preference, 802 "D" preference and 500 ordinary shares taken up. £510 paid on 510 "D" preference shares. £2,392 considered as paid on the remainder. Mortgages and charges, nil.

Tunewell Neon and Radio, Ltd.—Particulars filed of debentures not exceeding £1,400 authorised January 2nd, 1936, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,400.

Streamlite Electric Lamp Co., Ltd.—Capital, £100 in £1 shares. Return dated September 20th, 1935. All shares taken up. £100 paid. Mortgages and charges, £1,500.

Wood Electric Manufacturing Co., Ltd.—Capital, £1,000 in £1 shares. Return dated November 1st, 1935. 601 shares taken up. £601 paid. Mortgages and charges, £1,050.

Radio & Electrical Supplies (Western), Ltd.—Capital, £1,000 in £1 shares. Return dated March 19th (filed September 2nd), 1935. 750 shares taken up. £750 paid. Mortgages and charges, nil.

Mid-Cumberland Electricity Co., Ltd.—The nominal capital has been increased by the addition of £50,000 in £1 ordinary shares beyond the registered capital of £200,000.

Adelaide Electric Supply Co., Ltd.—Satisfaction to the extent of £400,000 on November 14th, 1935, of trust deed dated June 11th, 1918, and registered June 14th, 1918.

Radio Relays, Ltd.—Capital, £7,500 in 6,750 preference shares of £1 and 15,000 ordinary shares of 1s. Return dated August 5th, 1935. All shares taken up. £7,500 paid. Mortgages and charges, nil.

Cox's Radio & Electrical Co., Ltd.—Capital, £100 in £1 shares. Return dated December 31st, 1934 (filed September 12th, 1935). All shares taken up. £100 paid. Mortgages and charges, nil.

Venus Radio & Electrical Co., Ltd.—Capital, £1,000 in £1 shares. Return dated September 21st (filed November 19th), 1935. All shares taken up. £1,000 paid. Mortgages and charges nil.

Pauline Radio, Ltd.—Capital, £2,000 in £1 shares. Return dated October 28th, 1935. 1,700 shares taken up. £1,200 paid. £500 considered as paid. Mortgages and charges: £1,400.

Little Lever Radio Relay Co., Ltd.—Capital, £500 in £1 shares. Return dated September 24th, 1935. 300 shares taken up. £300 paid. Mortgages and charges, nil.

Swindon Radio Relay Exchange, Ltd.—Capital, £12,000 in 3,200 ordinary and 8,500 10 per cent. cumulative preference shares of £1 and 6,000 ordinary shares of 1s. Return dated October 4th, 1935. 3,200 £1 ordinary, 6,525 preference, and 6,000 1s. ordinary shares taken up. £8,925 paid on 2,500 £1 ordinary and 6,525 preference shares, £1,000 considered as paid on the remainder. Mortgages and charges, nil.

Wembley Relay Service, Ltd. (now Wembley Rediffusion Service, Ltd.).—Satisfaction to the extent of £3,000, on October 31st, 1935, of debentures authorised November 23rd, 1934, and registered December 18th, 1934. Balance of £2,000 has been extinguished.

Varsity Eliminator Co., Ltd.—F. G. Grubb, 30, King Edward's Gardens, Acton, W.3, ceased to act as receiver and manager on November 16th, 1935. (Notice filed January 8th, 1936.)

Bursiem's Patents, Ltd.—Issue on December 12th, 1935, of £500 debentures, part of a series already registered.

Particulars filed of £2,000 debentures authorised January 2nd, 1936, charged on the company's undertakings and property, present and future, including uncalled capital, the whole amount being now issued. (The above ranks pari passu with debentures created November 20th, 1935.)

Metropolitan Rediffusion Services, Ltd.—Satisfaction to the extent of £6,200 on October 31st, 1935, of debentures authorised November 20th, 1934, and registered December 18th, 1934. The balance of £3,800 has been extinguished. (Notice filed January 7th, 1936.)

General Signal & Time Systems, Ltd.—The nominal capital has been increased by the addition of £1,000 in £1 ordinary shares beyond the registered capital of £1,000.

Acme Plating & Electrical Co., Ltd.—Capital, £500 in 490 and 410 preference shares of £1. Return dated November 7th, 1935. 250 ordinary shares taken up. £125 paid. £125 considered as paid. Mortgages and charges: Nil.

Magnetic & Electric Alloys, Ltd.—Capital, £1,000 in £1 shares. Return dated November 15th, 1935. All shares taken up. £1,000 paid. Mortgages and charges: £2,500.

Dominion Battery & Accumulator Co., Ltd.—Capital, £100 in £1 shares. Return dated December 11th, 1935. 2 shares taken up. £2 paid. Mortgages and charges, nil.

Holmes & Cooper (Horsham), Ltd.—Capital, £2,000 in £1 shares. Return dated July 8th (filed September 12th), 1935. All shares taken up. £1,400 paid. £600 considered as paid. Mortgages and charges, nil.

Bylock Electric, Ltd.—Particulars filed of debentures not exceeding £4,500 authorised January 9th, 1936, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £4,500.

Pearl & Pearl, Ltd.—Debenture dated January 14th, 1936, to secure £3,500 charged on the company's undertaking, assets and uncalled capital. Holders: Control Nominees, Ltd., 21, Lombard Street, E.C.

Evendrawn Electric Lamp & Accessories Co., Ltd.—Debenture dated January 3rd, 1936, to secure £1,000, charged on the company's property, including uncalled capital. Holders: Ismay Industries, Ltd., Sterling Works, Dagenham.

Watson Marsh & Co. (Brondesbury), Ltd.—Deposit on January 1st, 1936, of deeds of garages and shop, &c., in Brondesbury, to secure all moneys due or to become due from the company to the Westminster Bank, Ltd.

Grossley Radio Co., Ltd.—Capital, £500 in £1 shares. Return dated December 31st, 1934 (filed September 27th, 1935). 303 shares taken up. £303 paid. Mortgages and charges, nil.

District Transmission Lines, Ltd.—Capital, £100 in £1 shares. Return dated December 11th, 1935. 20 shares taken up. £20 paid. Mortgages and charges, nil.

Gardner & Co. (Portsmouth), Ltd.—Capital, £1,000 in £1 shares. Return dated December 21st, 1934 (filed September 9th, 1935). 902 shares taken up. £2 paid. £900 considered as paid. Mortgages and charges, nil.

City Notes

The British Vacuum Cleaner & Engineering Co. proposes to increase its capital from £30,000 to £250,000 by the creation of 150,000 5½ per cent. redeemable preference shares of £1 and 100,000 ordinary shares of 14s. each. The undivided profits to the extent of £70,000 are to be capitalised in paying up 100,000 ordinary shares of 14s. each. These will be distributed to the holders of the 100,000 ordinary shares of 6s. each in the proportion of one for each one held. After the bonus issue the 100,000 14s. shares and 100,000 6s. shares will be consolidated into 100,000 £1 shares and then sub-divided into 400,000 ordinary shares of 5s. each. A public issue will be made next month of the 150,000 5½ per cent. redeemable preference shares. A meeting to consider these proposals will be held on February 11th.

Companies Struck Off the Register.—The names of the following companies have been struck off the Register and they are thereby dissolved:—British Electric Utilities Investment Trust, Ltd.; Finsbury Radio Co., Ltd.; Motor-Radio Developments, Ltd.; Ingleton Electric Lighting & Power Co., Ltd.; Radio Listeners, Ltd.; Westford Radio, Ltd.

J. & E. Hall, Ltd., report a profit for the year ended September 30th last of £194,272, as compared with £161,867 in the preceding year. After deducting management expenses, income tax provision, &c., and adding £1,261 brought in, the balance is £43,458. The ordinary dividend for the year is 6 per cent. (against 2½ per cent.), and £9,378 is carried forward.

The Palestine Electric Corporation has decided to issue 200,000 "A" ordinary shares of £1 sterling each to existing holders of ordinary and "A" ordinary shares, at 45s. per share in the proportion of one new "A" ordinary share to eight ordinary or "A" ordinary shares held.

The Mersey Railway Co. has decided to pay the full dividend of 3 per cent. on the perpetual preference stock and to recommend a dividend of ¾ per cent. on the ordinary stock (unchanged).

Standard Switchgear, Ltd. (a private company) report that at their annual meeting the accounts submitted for the year ended November 30th, 1935, showed an increase of 25 per cent. in output over the previous year. The net trading profit was 20 per cent.

The Singapore Traction Co. proposes to pay a dividend of 10 per cent. on the 7 per cent. cumulative preference shares on account of arrears, partly payable out of the profits of the current year.

The Yorkshire Electric Power Co. is again paying a final dividend of 5 per cent. on the ordinary stock, making 8 per cent. for the year (same).

The City of Buenos Aires Tramways Co. (1904), Ltd., is paying the usual quarterly dividend on the £5 shares of 1s. 3d. per share, less tax.

Stocks and Shares

TUESDAY EVENING.

THE Stock Exchange, in common with the other Exchanges, has been closed to-day, Tuesday, on account of the funeral of King George. The City, deeply moved by his death, remained calm in the face of the Nation's great loss. The beginning of the new reign of King Edward VIII has taken place in the same atmosphere of expanding confidence which was a marked feature of the later part of his father's reign.

The possibility, discussed here last week, that Continental holders of British stocks would become nervous at the changes in this country and, as a result, turn out stock upon markets temporarily deprived of their usual support, has not materialised. The market in gilt-edged securities has remained quietly steady. The stocks of the Central Electricity and London Passenger Transport Boards reflect the prevailing tendency and their prices remain unaltered.

In other markets of the Stock Exchange the growth of confidence in the best home industrial companies is unchecked. It has received welcome encouragement from the result of the coal discussions. Confidence is branching out into a num-

ber of directions in which interest has for some time past been lacking. The successful issue of the Southern Company's rating appeal is mainly responsible for a general upward movement in Home Railway stocks, while abroad, the prospect of improved trading conditions in Brazil and in the Argentine is producing a similar trend.

Electricity Supply Shares

The market in electricity supply shares has taken its tempo from the gilt-edged market. Business has been on a small scale, and changes in price are few. Of the London companies, "Cities," "Counties" and Metropolitans have improved. Edmundsons and North Eastern rose 6d. each. The latter are the subject of a fair amount of activity. The price of Yorkshire Electric, like the dividend, is unchanged.

Victoria Falls ordinary have moved up to 73s. 9d. Perak Hydro-Electrics hardened to 25s. 3d., Palestine Electrics to 56s.

Manufacturing and Equipment

The market in shares of companies manufacturing electrical equipment is one of the strongest and most consistently popular in the Stock Exchange. The industry is considered to be at the beginning of an era of fresh prosperity. Buyers, in their eagerness to secure shares in the leading companies, are quite prepared to ignore the modesty of the yields obtainable, not only at the present rates of dividend distribution, but even those in prospect for the near future. General Electrics at 81s. have scored yet another substantial advance, this time of 2s. At this price the yield is barely 2½ per cent. on the basis of last year's 10 per cent. dividend. There can, of course, be little doubt that the dividend will be materially higher in respect of the current year, and as mentioned here before, there is always the possibility of a bonus distribution. The recent buyers claim that the prospects of the company are such as to make the shares cheap even at the present level. Of the other leaders in this group, Associated Electrical are a further 6d. up at 45s. 6d. Henley's gained $\frac{3}{16}$ at 7¼. Rises of 2s. 6d. each have taken place in Enfield Cable, Ericssons, Callenders and Electric Construction. Siemens are ¼ better at 27s. 6d. After various fluctuations, Crompton Parkinson remain unchanged at 67s. 6d. For a few minutes last week the shares were 70s. bid.

Telegraph and Telephone

The opinion was expressed here last week that, had the Cable and Wireless December traffic statement been received at a more propitious moment, the effect would have been a rise in the price of Cable and Wireless preference stock. The satisfactory nature of that statement has now had time to be appreciated and demand for the stock has carried the price 4 points higher to 110. Incidentally, this brings the price 10s. above that of the London Passenger Transport Board's "C" stock. No change took place in the Cable and Wireless "A" and "B" stocks. Globe Telegraph and Trust shares were irregular, the preference gaining 5s. to 14⅝, and the ordinary losing 2s. 6d. to 15⅛. American Telephone and Telegraphs are a point lower at 160½. Anglo-American preferred went up 1½ points to 124½. Great Northern Telegraph have similarly appreciated to 42½.

B.E.T. and Brazil Traction

British Electric Traction deferred stock has put on a further 30 points and now stands at 1695. At the time of writing there is on offer a line of £10,000 of the 8 per cent. non-cumulative preferred ordinary stock of this company. The price, at 175½, provides a yield of £4 11s. on the money. The net profits of the company have risen from £251,000 in 1926 to £379,000 for the year ended last March, and the dividend on the preferred stock is being earned nearly 2½ times over. The company, in the same way as Tillings, is likely to be receiving benefits from the activities of the London Passenger Transport Board. The stock on offer would fulfil the requirements of a good many investors, and the price does not look too high. Tillings have advanced to 85s.

Brazil Traction have returned to favour, as is shown by a rise of 2⅜ to 12⅝. The question of exchange has been one of this company's greatest difficulties for some years, and the amelioration which seems to be taking place in that direction should be of the greatest advantage to the company and its shareholders. The absence of recent dividends has been mainly due to loss incurred in remitting funds from Brazil. Another favourable factor in the company's outlook is the possibility of an increase in fares over the existing rates.

Miscellaneous Matters

The shares of Babcock and Wilcox have risen 1s. 6d. to 54s. 6d. The removal of coal-strike fears has naturally been viewed with great relief in the market for iron, coal and steel companies' shares: prices have rallied generally. Turner and Newall shares are again higher at 77s. 3d. British Vacuum Cleaner have been outstanding with a rise of 17s. 6d. to 110s. since January 20th. Dealings in the new Max Stone issues began at 3s. for the ordinary, issued at 2s. 9d., and 9s. 9d. for the 10s. preference, offered at par. A mild feature of the past few days has been the recovery of resilience in the rubber share market. The spot price of the produce rose to 7d. per lb., a rise which served to revive hopefulness and to energise business in the market for rubber shares.

Share List of Electrical Companies

	Nom.	Dividend 1933.	Dividend 1934.	Price Jan. 28	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	37/6	—	3 17 5
City of London	1	7½	7½	38/6	+6d.	3 18 0
Clyde Valley	1	7	8	46/–	—	3 9 7
County of London	1	10½	10½	58/–	+6d.	3 12 5
Edmundson's 7% Pref.	1	7	7	36/6	+6d.	3 16 9
Do. Ord.	1	7	8	45/–	+6d.	3 11 0
Elec. Dis. Yorkshire	1	9	9	48/–	—	3 15 0
Elec. Fin. and Securities	1	12½	12½	3 7/16	—	3 12 9
Elec. Supply Corporation	1	11	11	3 5/8	—	3 9 0
Lancs Light and Power	1	7½	7½	39/6	—	3 16 0
Lond. Assoc. Electric	1	—	—	36/–	—	3 17 9
London Electric	1	7	8	40/6	—	3 19 0
London Power Deb. Red.	Stock	5	5	109½	—	4 11 4
Metropolitan	1	10	10	54/–	+1/–	3 14 1
Midland Counties	1	7	7	41/–	—	3 8 4
Mid. Elec. Power	1	8	8	42/6	—	3 15 3
North Eastern Electric Ordinary	1	6	6	35/–	+6d.	3 8 7
Do. 7% Pref.	1	7	7	35/6	—	3 19 0
Northampton	1	10	10	55/–	—	3 12 0
Notting Hill 6% Pref.	10	6	6	14½	—	4 2 0
North Met. Elec. Ordinary	1	10	10	62/–	—	3 4 6
Do. do. 6% Pref.	1	6	6	32/–	—	3 15 0
Scottish Power	1	8	8	43/9	—	3 13 2
South London	1	7	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/6	—	5 17 8
Yorkshire Elec.	1	8	8	47/–	—	3 8 0
PUBLIC BOARDS.						
Central Electricity 1950–70	Stock	5	5	118	—	4 4 9
Do. 1955–75	,,	5	5	120	—	4 3 4
Do. 1951–73	,,	4½	4½	111	—	4 1 1
Do. 1963–93	,,	—	3½	106	—	3 6 0
London Elec. Trans. Gtd.	,,	—	2½	97	—	2 11 8
London & Home Counties, 1955–75	,,	4½	4½	112	—	4 0 4
London Passenger Transport, A.	,,	—	4½	127	—	3 11 0
Do. do. B.	,,	—	5	130½	—	3 16 8
Do. do. C.	,,	3½	4	109½	—	3 13 2
West Midlands Joint Elec. 1948–68	,,	—	5	116½	—	4 5 10
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$100	9	9	160½	—1	5 12 5
Anglo-Am. Tel. Pref.	Stock	6	6	124½	+1½	4 16 5
Do. Def.	,,	1½	1½	30	—	5 0 0
Cable & Wireless 5½% Pref.	,,	2¾	4½	110	+4	3 15 0
Do. A. 7½% Ord.	,,	Nil	Nil	29¾	—	—
Do. B. Ord.	,,	Nil	Nil	8	—	—
Globe Tel. & Tel. Ord.	10	2½	3½*	15½	—½	2 6 0
Do. do. Pref.	10	6	6	14½	+½	4 2 0
Great Northern Tel.	10	20	20	42½	+1½	4 14 1
Marconi-Marine	1	10	7½	37/6	—	4 0 0
Oriental Telephone Ord.	1	12	12	3¼	+¼	3 13 10
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	1/–	—	—
Do. do. 2nd Pref.	5	Nil	Nil	9d.	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	,,	5	5	1695	+30	—
Do. do. Pref. Ord.	,,	8	8	174½	+1	4 11 8
Brazil Traction	100	—	—	12⅜	+2⅜	—
Brit. Columbia Elec. Rly. Pfd.	Stock	5	5	98½	—2	5 1 6
Mexican Light Common	100	Nil	Nil	2½	—	—
Do. 7% Pref.	100	7	7	3	—	—
Do. 1st Bonds	$500	5	5	50	—	—
Victoria Falls Ord.	1	20	20	3 11/16	+1/16	—
West Riding	1	5	6½	52/6	—	2 9 6
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	10	15	55/–	—	5 9 0
Assoc. Elec. Ord.	1	4	6	45/6	+6d.	2 12 9
Do. Pref.	1	8	8	39/–	—	4 2 1
Babcock & Wilcox	1	6	8	54/6	+1/6	2 18 9
British Aluminium Ord.	1	5	7½	43/3	—	3 9 6
British Insulated Ord.	1	5	15	5 1/16	+ 1/16	2 19 3
Brush Ord.	Stock	Nil	Nil	46½	—	—
Callender's	1	15	15	4¼	+¼	3 12 10
Do. 6½% Pref.	1	6½	6½	31/3	—	4 3 2
Crompton Parkinson Ord.	5/–	—	12½	67/6	—	0 10 0
Do. 8% Pref.	1	8	8	38/9	—	4 2 7
Edison Swan 1st Pref.	1	7½	7½	33/9	—	4 9 0
Electric Construction	1	Nil	3½	2	+½	1 15 0
Enfield Cable Ord.	1	25	25	5 1/16	+¼	4 4 0
English Electric	1	Nil	Nil	22/–	—	—
Do. do. Pref.	1	Nil	Nil	24/6	—	—
Ericsson Tel.	5/–	—	24	37/6	+¼	—
Ever Ready	5/–	35	35	24/6	—	7 2 10
Ferranti Pref.	1	7	7	27/–	—	5 3 8
G.E.C. Pref.	1	6½	6½	33/6	—	3 17 7
Do. Ord.	1	8	10	81/–	+2/–	2 9 8
Henleys	1	30	30	7¼	+ 3/16	4 2 8
Do. 4½% Pref.	5	4½	4½	5⅞	—	3 18 3
India-Rubber Preferred	1	—	5½	1¼	—	4 17 9
Johnson & Phillips	1	5	7½	50/–	—	3 0 0
Siemens Ord.	1	6½	4	27/6	+1/16	2 18 2
Telegraph Construction	£1	Nil	Nil	26/3	—	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1934

8868. "Mechanism for inserting paper between the layers of wire in coils for electrical purposes." J. W. Geddes. March 21st, 1934. (440401.)

15780. "Cathode-ray tubes more particularly for television purposes." D. S. Loewe Radioakt.-Ges. May 27th, 1933. (440560.)

16188. "Radio receivers." Telefunken Ges. für Drahtlose Telegraphie. May 30th, 1933. (Cognate application 16189/34.) (440485.)

18305. "Thermally operated release devices for automatic electric switches." Schiele & Bruchsaler-Industrie-Werke, Akt.-Ges., and J. A. Crabtree & Co., Ltd. June 21st, 1933. (440413.)

18531. "Covering for cables." Allgemeine Elektricitäts-Ges. June 22nd, 1933. (440490.)

18639. "Electrical conductors." London Electric Wire Co. & Smiths, Ltd., and J. R. Abraham. June 23rd, 1934. (440561.)

18762. "Remote control and indicating systems for radio relay stations." Marconi's Wireless Telegraph Co., Ltd. June 23rd, 1933. (440425.)

18875. "Metallic vapour lamps and gaseous-discharge devices." P. Freedman. June 26th, 1934. (440426.)

18898. "Electrolytic condensers." Elektrizitäts Akt.-Ges. Hydrawerke. June 27th, 1933. (440427.)

19054. "Thermionic valve and like base arrangements." Marconi's Wireless Telegraph Co., Ltd. August 3rd. 1933. (Cognate application 19055/34.) (440430.)

19064. "Electric measuring instruments." Nalder Bros. & Thompson, Ltd., C. L. Lipman, H. M. Clarke and C. W. D. Johnson. June 28th, 1934. (440563.)

19164. "Magnetic devices for use in train control or railway signalling systems." H. H. Harrison. June 28th, 1934. (440435.)

19171. "Method of operating track relays in railway signalling systems and devices for use therewith." Michelin & Cie. June 28th, 1934. (Cognate applications 19172/34 and 19173/34.) (440436.)

19276. "Systems for indicating electrical variations in physical quantities." Leeds & Northrup Co. June 29th, 1933. (440648.)

19303. "Electrically energised clock systems." Telephone Manufacturing Co., Ltd., M. Simons and J. G. Flint. June 29th. 1934. (440439.)

19304. "Electrically energised clocks." Telephone Manufacturing Co., Ltd., and M. Simons. June 29th, 1934. (440440.)

19359. "Interlocking mechanism for enclosed electric switch fuse combinations." J. A. Crabtree. June 30th, 1934. (440441.)

19389. "Electric-discharge tubes." W. W. Triggs (Naamlooze Vennootschap Machinerieen-en Apparaten Fabrieken Meaf. June 30th, 1934. (440566.)

19414. "Thermally operated control devices for electric switches." A. Sadler (Schiele & Bruchsaler Industrie, Akt.-Ges.). July 2nd, 1934. (440654.)

19474. "Automatic volume control in radio receiving apparatus." Murphy Radio, Ltd., and L. A. Moxon. July 2nd, 1934. (440494.)

19495. "Control of electrically propelled vehicles." British Thomson-Houston Co., Ltd., and J. H. Cansdale. July 2nd, 1934. (440570.)

19499. "Electric induction motors." J. W. Swendsen. December 4th, 1933. (440571.)

19512. "Two-way communication systems." Marconi's Wireless Telegraph Co., Ltd., and F. M. G. Murphy. July 2nd, 1934. (440572.)

19709. "Loudspeakers and the like." R. R. Glen. July 4th, 1934. (440726.)

19741. "Film television." C. O. Browne. July 4th, 1934. (440729.)

19816. "Control of direct-current motors." British Thomson-Houston Co., Ltd. July 5th, 1933. (440734.)

19897. "Electric transformers particularly adapted for grid controlled gaseous-discharge tube apparatus." Standard Telephones & Cables, Ltd. July 12th, 1933. (440739.)

19901. "Electrical tele-indicating devices." Schneider & Cie. February 22nd, 1934. (Addition to 428899.) (440740.)

19919. "High-frequency variable coupling or attenuation devices." Marconi's Wireless Telegraph Co., Ltd., S. B. Smith and F. M. Wright. July 6th, 1934. (440745.)

20023. "Supporting devices for gas, electric and other lamps." W. Slingsby & Co., Ltd., W. Slingsby, T. J. L. Slingsby and W. N. Slingsby. July 9th, 1934. (440662.)

20099. "Electric light fittings." R. W. Buckingham. July 9th, 1934. (440663.)

20302. "Electric switch socket combinations of the interlocking type." Simplex Electric Co., Ltd., P. W. Davis and F. W. Osborn. July 11th, 1934. (440497.)

20305. "Systems for automatically controlling the speed of electric motor driven hoists and the like." British Thomson-Houston Co., Ltd. July 20th, 1933. (440498.)

21019. "Apparatus suitable for transporting electric cables." Okonite-Callender Cable Co., Inc. July 19th, 1933. (440499.)

22281. "Electromagnetic relay arrangements for use in electrical control or alarm systems." Weston Electrical Instrument Corporation. June 29th, 1934. (440665.)

24039. "Electric rectifiers or invertors." British Thomson-Houston Co., Ltd. August 26th, 1933. (440505.)

24476. "Electric fans." H. H. C. Fuller and H. M. Gibson. August 28th, 1934. (440446.)

25251. "Optical systems." J. L. Baird and Baird Television, Ltd. September 5th, 1934. (440577.)

29345. "Electric switches or circuit-breakers." G. Ellison, Ltd., and J. Anderson. October 17th, 1934. (Addition to 345454.) (440513.)

30016. "Automatic telephone selectors." B. J. Brander. October 19th, 1934. (440678.)

30321. "Thermionic amplifiers." G. Krawinkel. October 25th, 1933. (440451.)

34392. "Incandescent electric lamps." J. T. F. Conti. November 30th, 1934. (Convention date not granted.) (440455.)

35084. "Method of reclaiming the mounts of burned-out electric lamps." Lamp Patent, Ltd. (W. R. Freeman). December 6th, 1934. (Convention date not granted.) (440586.)

1935

40. "Electric radiators." S. Hooper. January 1st, 1935. (440756.)

536. "Multiple contact-bank for automatic telephone selectors." B. J. Brander. January 7th, 1935. (440685.)

1587. "Multi-conductor electric cables." Cablon, Ltd. (M. Hochstadter). January 17th, 1935. (440592.)

4360. "Electrically indicating instruments particularly adapted for use as radio tuning indicators." British Thomson-Houston Co., Ltd. February 10th, 1934. (440528.)

6047. "Electric cables for the transmission of high-frequency currents." Siemens & Halske Akt.-Ges. November 30th, 1934. (440596.)

7076. "Electric motors." British Thomson-Houston Co., Ltd. March 6th, 1934. (440532.)

7342. "Electrically driven reciprocating pumps for liquid." M. Blaskope and G. Szekely. March 9th, 1934. (440693.)

7452. "Resistance units and method of making the same." International Resistance Co. March 9th, 1935. (Addition to 433047.) (440762.)

8446. "Electrolytic manufacture of borides." Soc. d'Electro-Chimie, d'Electro-Metallurgie, et des Acieries Electriques d'Ugine, and J. L. Andrieux. March 17th, 1934. (440764.)

9028. "Systems for remote control of railway track switches and signals." General Railway Signal Co. April 21st, 1934. (440765.)

9056. "Dial arrangements for broadcast receiving apparatus." Ideal Werke Akt.-Ges. für Drahtlose Telephonie. April 16th, 1934. (440535.)

10678. "Incandescent electric igniters." A. Ruprecht. April 6th, 1935. (440465.)

12506. "Compound high-frequency iron cores." R. Bosch Akt.-Ges. April 28th, 1934. (440468.)

14485. "High-temperature sources of ultra-violet light." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 18th, 1934. (440778.)

14489. "Light signal beacons." Bartow Beacons, Inc. May 26th. 1934. (440779.)

14531. "Electrically operated suction cleaners and the like." Apex Electrical Manufacturing Co. June 30th, 1933. (Divided out of 19114/34.) (440704.)

14606. "Electron-discharge device amplifiers." Telefunken Ges. für Drahtlose Telegraphie. May 29th, 1934. (440612.)

14731. "Electric lamps and method of making the same." British Thomson-Houston Co., Ltd. May 22nd, 1934. (440542.)

14828. "Cathode for electric-discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 13th, 1934. (440780.)

16559. "Manufacture of alternating electric current rectifiers." Westinghouse Brake & Signal Co., Ltd. October 19th, 1934. (440708.)

16846. "Production of modulated high-frequency electric currents." G. Krawinkel. June 11th, 1934. (440474.)

17109. "Earth-leakage protective systems for electric mains apparatus." C. Frydenlund. June 13th, 1935. (440783.)

17291. "Automatic telephone selectors." B. J. Brander. October 19th, 1934. (Divided out of 440678.) (440709.)

17722. "Evacuating means for electronic and ionic valves." Allmänna Svenska Elektriska Aktiebolaget. June 22nd, 1934. (440616.)

19482. "Inductance coils." C. Lorenz Akt.-Ges. July 10th, 1934. (440791.)

19638. "Electric-discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 26th, 1934. (440551.)

22075. "Telephone earpieces." E. Hausdorf. August 3rd, 1935. (440626.)

22667. "Method of utilising consumed electric storage batteries." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 14th, 1934. (440629.)

23940. "Telephone pay stations for variously rated calls." Telephon-Apparat-Fabrik, E. Zwietusch & Co., Ges. January 11th, 1935. (440795.)

27347. "Automatic frequency regulation of alternating-current supplies." General Electric Co., Ltd., and J. W. Gibson. March 20th, 1934. (Divided out of 238/34.) (440635.)

32290. "Electric-discharge tubes." W. W. Triggs (Naamlooze Vennootschap Machinerieen-en Apparaten Fabrieken Meaf). June 30th, 1934. (Divided out of 440566.) (440636.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 22nd :—

Temcoloy. No. 564104. Class 5. Electrical resistance alloys (unwrought or partly wrought), and wire in round or flattened section.—Temco, Ltd., Stowfield Works, Lydbrook, Glos.

Impex. No. 563580. Class 6. Dynamos and parts thereof, &c.—Suddeutsche Metallwerk Gesellschaft, Walldorf, Baden, Germany (British representatives : Alexander & Ham, 25, Stirling Road, Edgbaston, Birmingham).

Centralab (lettering and design). No. 561556. Class 8. Fixed or variable resistances for use in radio circuits, and devices for suppressing spark noise in radio receiving sets.—Central Radio Laboratories, Milwaukee, Wis., U.S.A. (British representatives : Frank B. Dehn & Co., Kingsway House, 103, Kingsway, W.C.2).

Pavaex (lettering and design). No. 564109. Class 11. Electrical vascular exercising apparatus (not medicated) for curative purposes.—Short & Mason, Ltd., Aneroid Works, Macdonald Road, Walthamstow, E.17.

Oxil. No. 564059. All goods in Class 13.—Allbright Electric Co., Ltd., 2-5, Dingley Place, City Road, E.C.1.